CAPTURING THE STATE OF KNOWLEDGE IN EURAD KNOWLEDGE MANAGEMENT
EURAD WP11 State-of-Knowledge (SoK)

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OUTLINE

- **Introduction**

- **Capturing the State-of-Knowledge**

  - Structuring the Knowledge – GBS

  - Types of KM Documents

  - KM Document Implementation Procedures

- **Status of KM Document Production**

  - KM Documents Status

  - Lessons Learnt from KM Document Production

- **Making the State-of-Knowledge Available**

  - Review of Existing KM Systems and Tools

  - The EURAD Wiki

- **Conclusions and Outlook**

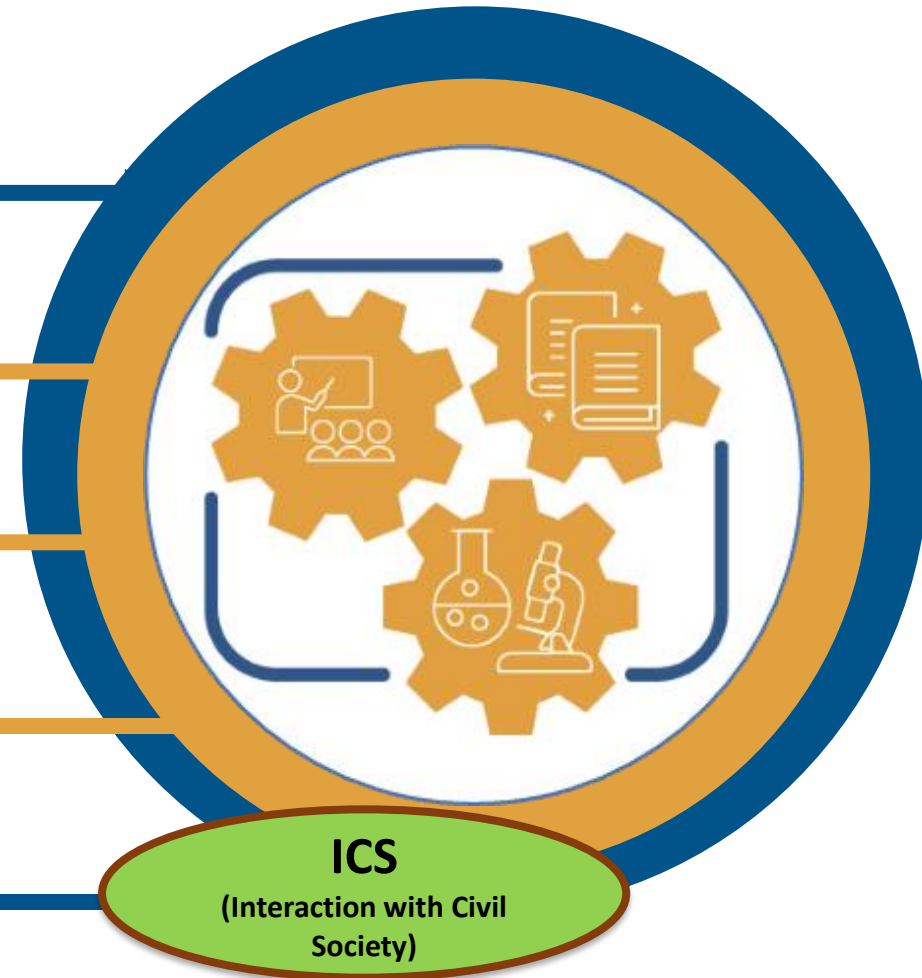# INTRODUCTION: EURAD KNOWLEDGE MANAGEMENT & NETWORKING PROGRAMME

1 **Roadmap / GBS**
A common framework to structure knowledge

2 **State of Knowledge**
What we know and why it is important

3 **Guidance**
Best practice and lessons learned

4 **Mobility & Training**
Transfer of experience and know-how

5 **Networking & Tools**
Connecting people to people, and people to content

ICS
(Interaction with Civil Society)

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INTRODUCTION: EURAD KNOWLEDGE MANAGEMENT & NETWORKING PROGRAMME
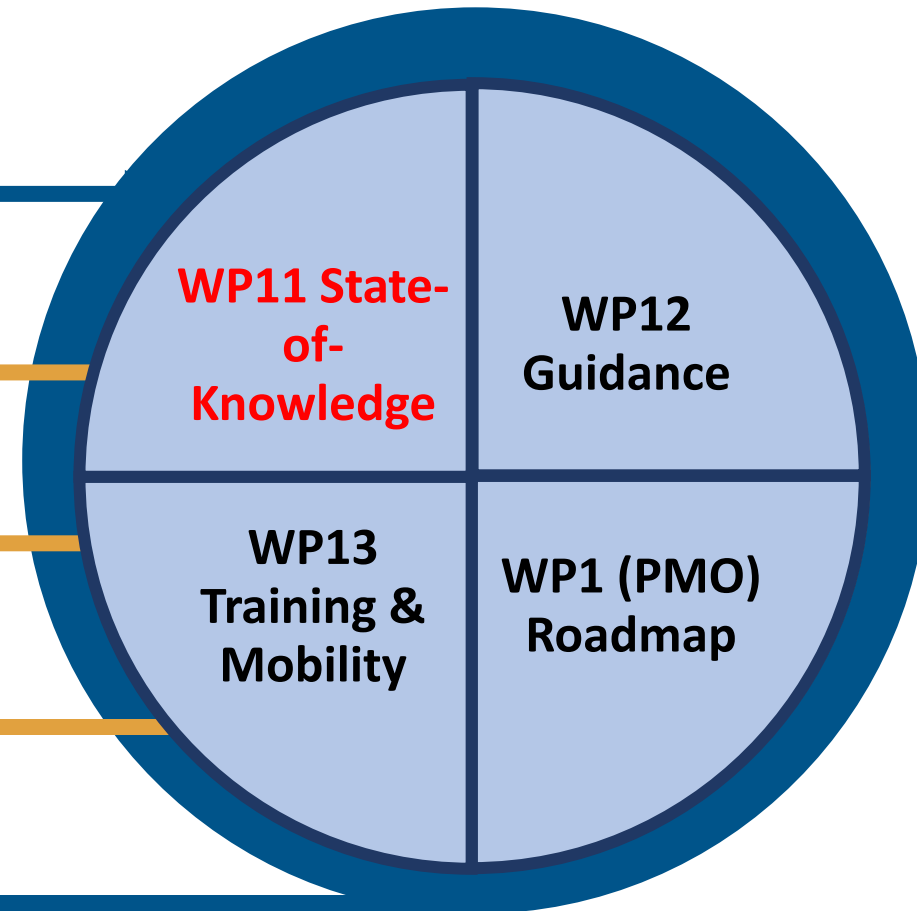
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WP11 State-of-Knowledge

WP12 Guidance

WP13 Training & Mobility

WP1 (PMO) Roadmap

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WP11 STATE-OF-KNOWLEDGE GOALS

- **State-of-Knowledge (SoK): the science and technology underpinning RWM in a given topic**

- **Main Goal:**

  - Establish the SoK, i.e. preserving, capitalising and providing open-access to knowledge that can be extracted by present and future generation of experts, and end-users in Europe and other stakeholders in Europe and beyond: WMOs, TSOs, REs, Programme Owners, Civil Society

- **Approach: collecting experts' view on the most relevant knowledge and associated uncertainties in a specific domain associated to RWM**

  - Production of KM (Knowledge Management) documents and making them publically available

  - Agile "learning-by-doing" approach: achieving content quickly, rather than focussing on processes first
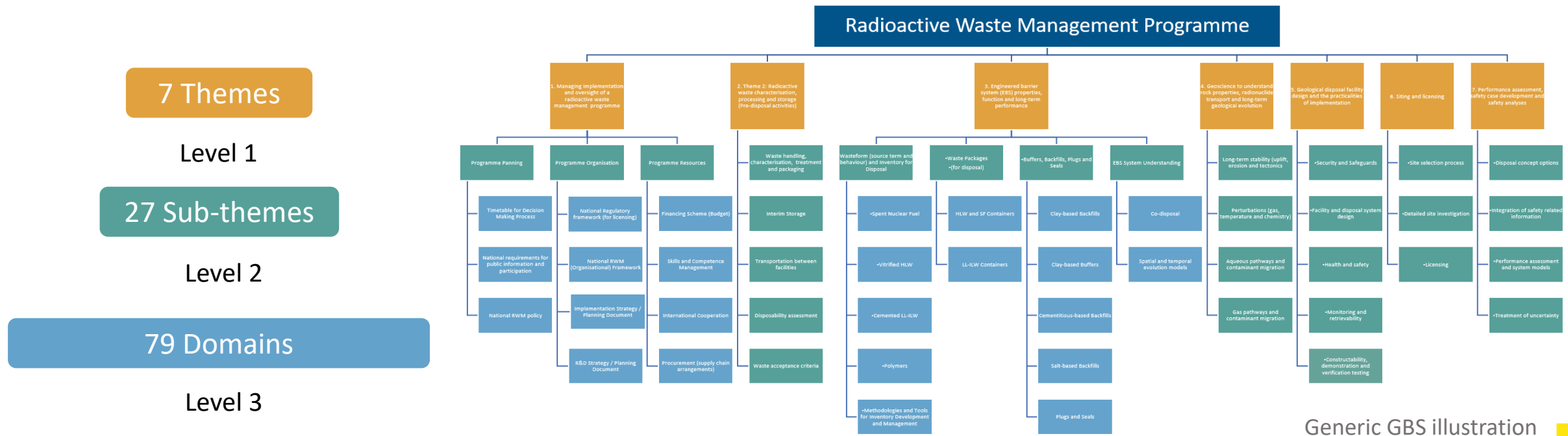
WP11 STATE-OF-KNOWLEDGE MOTIVATION

- **Challenges KM is addressing:**

  - Transfer of knowledge from advanced to early-stage programmes

  - Advanced programmes that want to asses the work they have performed

  - Generational change (capturing the knowledge of retiring generation)

  - Transfer of knowledge to the new entrants to the field (new employees at WMOs, TSOs, REs, students, civil society, etc.)

  - Identify knowledge gaps for RD&D, Guidance, Training & Education

TOPICS ALIGNED WITH THE EURAD GOALS BREAKDOWN STRUCTURE (WP 1)

GBS: Hierarchical structuring of topics allows organisation of and navigation through knowledge
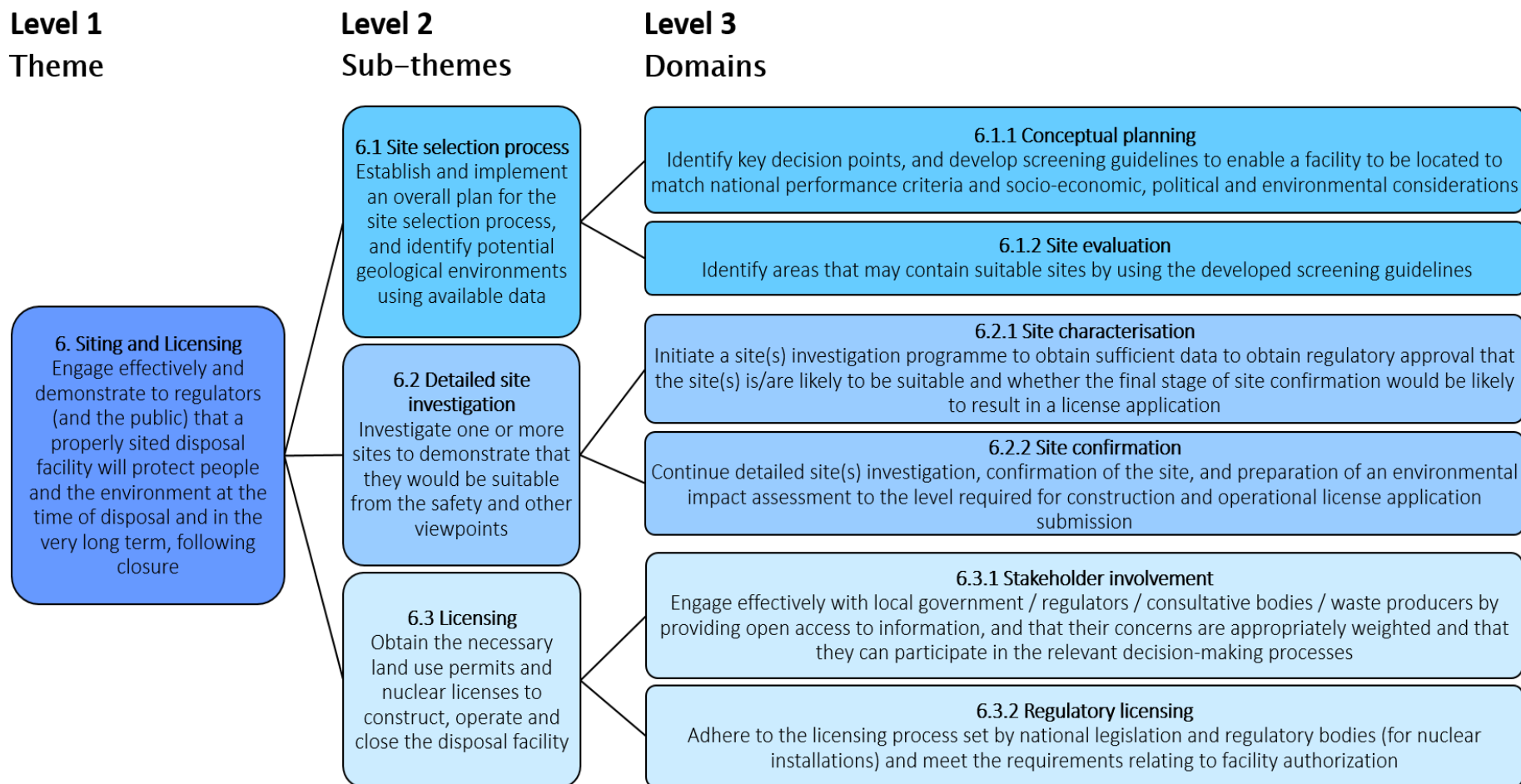
→ Documents on different levels

7 Themes
Level 1

27 Sub-themes
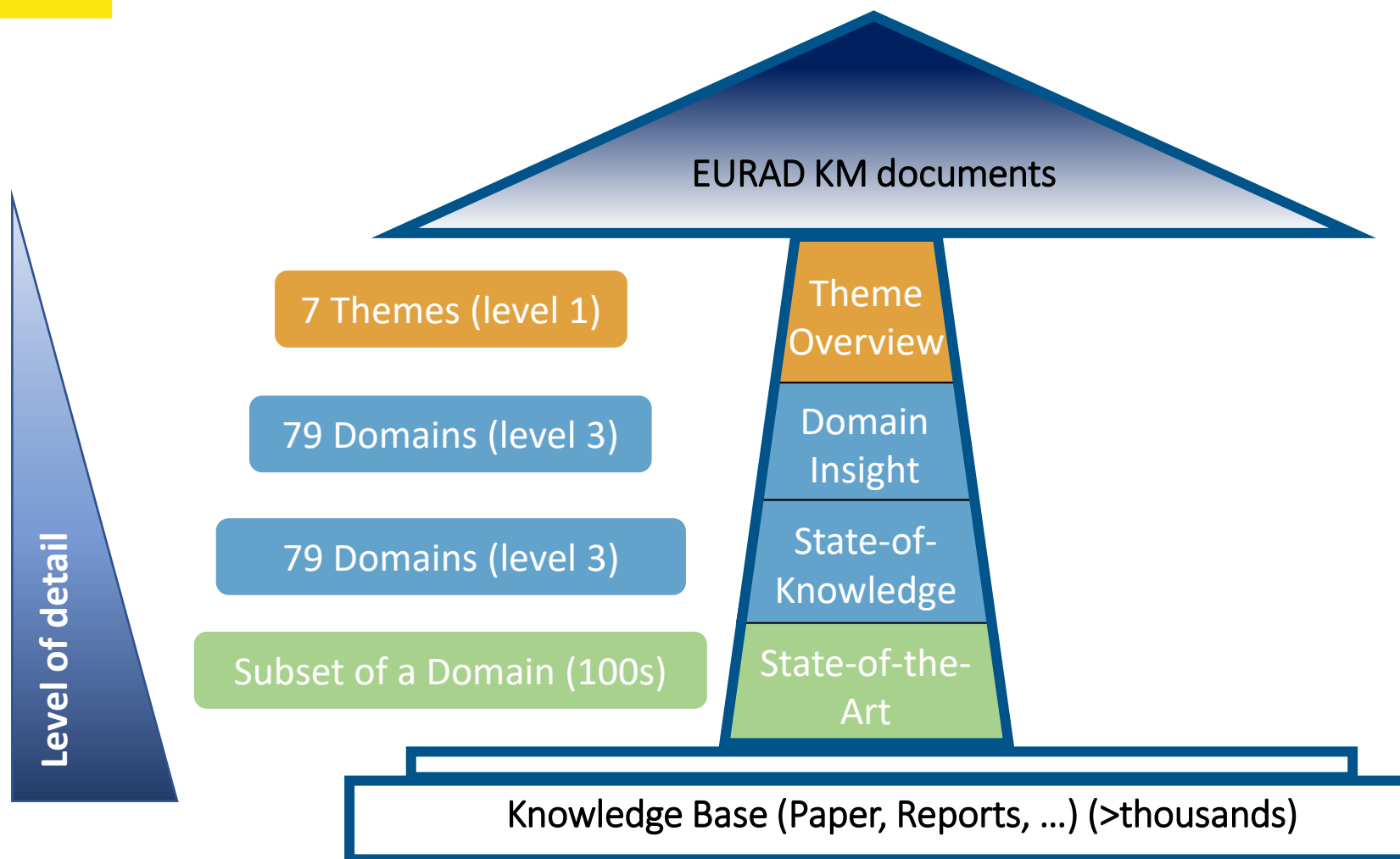Level 2

79 Domains
Level 3

Generic GBS illustration

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

EXAMPLE OF ROADMAP STRUCTURE: BREAKDOWN OF THEME 6

Level 1
Theme

Level 2
Sub–themes

Level 3
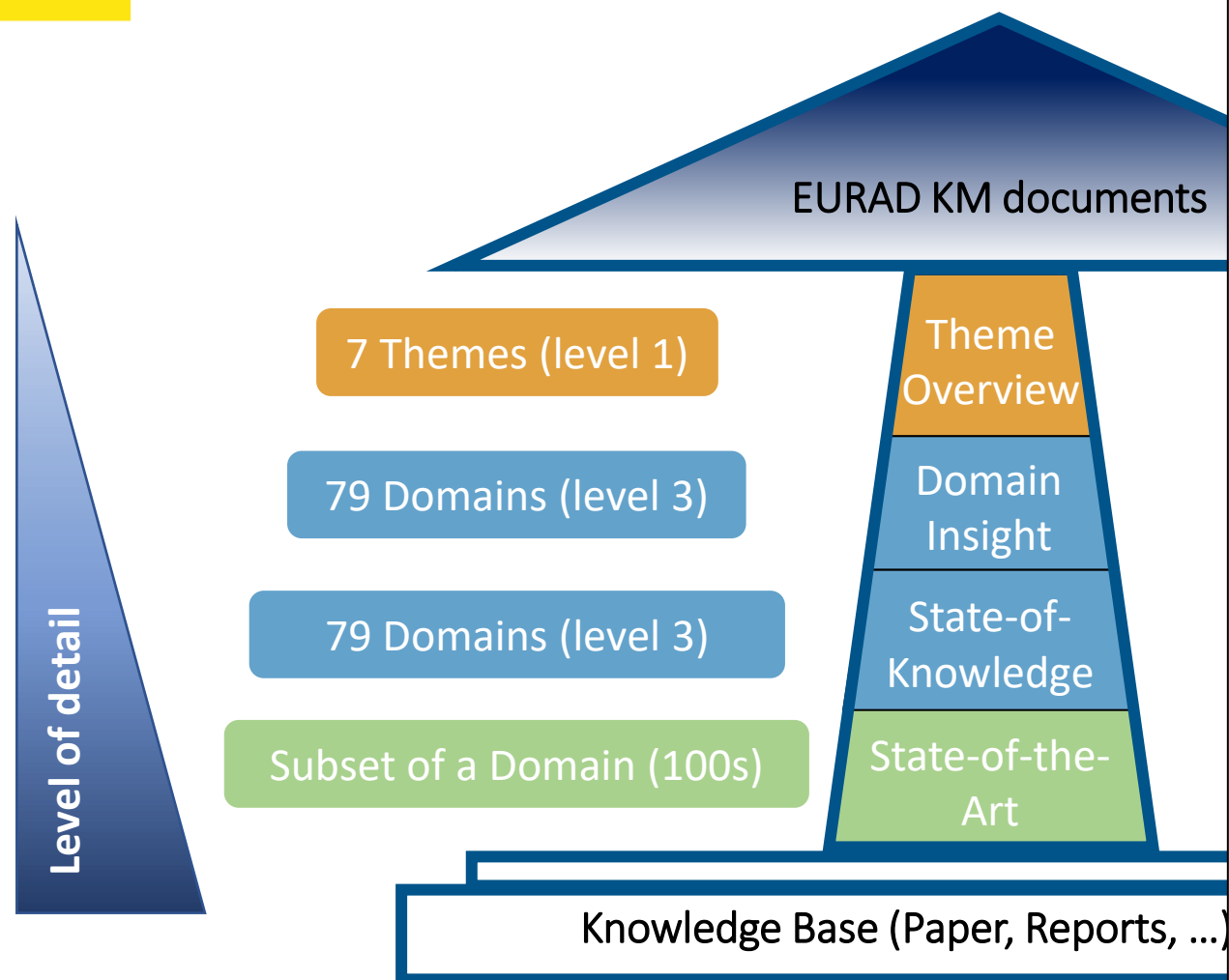Domains

Themes of the GBS:

1. National Programme Management
2. Pre-disposal
3. Engineered Barrier System
4. Geoscience
5. Disposal facility design and optimisation
6. **Siting and Licensing**
7. Safety Case

6. Siting and Licensing
Engage effectively and demonstrate to regulators (and the public) that a properly sited disposal facility will protect people and the environment at the time of disposal and in the very long term, following closure

6.1 Site selection process
Establish and implement an overall plan for the site selection process, and identify potential geological environments using available data

6.2 Detailed site investigation
Investigate one or more sites to demonstrate that they would be suitable from the safety and other viewpoints

6.3 Licensing
Obtain the necessary land use permits and nuclear licenses to construct, operate and close the disposal facility

6.1.1 Conceptual planning
Identify key decision points, and develop screening guidelines to enable a facility to be located to match national performance criteria and socio-economic, political and environmental considerations

6.1.2 Site evaluation
Identify areas that may contain suitable sites by using the developed screening guidelines

6.2.1 Site characterisation
Initiate a site(s) investigation programme to obtain sufficient data to obtain regulatory approval that the site(s) is/are likely to be suitable and whether the final stage of site confirmation would be likely to result in a license application

6.2.2 Site confirmation
Continue detailed site(s) investigation, confirmation of the site, and preparation of an environmental impact assessment to the level required for construction and operational license application submission

6.3.1 Stakeholder involvement
Engage effectively with local government / regulators / consultative bodies / waste producers by providing open access to information, and that their concerns are appropriately weighted and that they can participate in the relevant decision-making processes

6.3.2 Regulatory licensing
Adhere to the licensing process set by national legislation and regulatory bodies (for nuclear installations) and meet the requirements relating to facility authorization

KM DOCUMENT STRUCTURE

EURAD KM documents

7 Themes (level 1)	Theme Overview
79 Domains (level 3)	Domain Insight
79 Domains (level 3)	State-of-Knowledge
Subset of a Domain (100s)	State-of-the-Art

Level of detail

Knowledge Base (Paper, Reports, …) (>thousands)

KM DOCUMENT STRUCTURE

Level of detail

EURAD KM documents

7 Themes (level 1)

79 Domains (level 3)

79 Domains (level 3)

Subset of a Domain (100s)

Theme Overview

Domain Insight

State-of-Knowledge

State-of-the-Art

Knowledge Base (Paper, Reports, …)

Theme Overview
Broad description of programme goals and typical activities for each theme and how they evolve over the phases of implementation

Domain Insight (WP11)
Context documents that provide direct links for each knowledge domain to safety and implementation goals related to DGR requirements

State-of-Knowledge (WP11)
Experts' view of the most relevant knowledge and associated uncertainties in a specific domain applied in the context of a radioactive waste management programme

State-of-the-Art
Oriented on a WP subject with narrower scope than a Domain. Focus on detailed mechanistic or process level understanding.

STATUS OF KM DOCUMENT PRODUCTION

First SoK document on SNF (3.1.1)

- **Author: Kastriot Spahiu**
- **Topic: Spent Nuclear Fuel**
- **Reviewed by 11 organizations**

"Globally I am very positively surprised by this SoK. It seems to me that it offers a good balance between providing a broad overview + detailed and scientific information about the topic (without being a detailed SOTA)....."

"We congratulate Kastriot for this excellent authoritative review which will be a long-lasting guide for research and development in the area of spent nuclear fuel as waste form. It provides a comprehensive but still compact and condensed introduction to the subject – it comprises pretty much every relevant aspect. It is an almost ideal introduction in particular for young scientists...."

EURAD
State of the Knowledge (SoK) Report

Spent Nuclear Fuel
Domain 3.1.1

Kastriot Spahiu
SKB, Stockholm and Chalmers University of Technology,
Gothenburg, Sweden

Version : 1.0 ; 09 November 2021

Please note: The statements made within this document are not necessarily the views of EURAD or any of its members. They represent the author(s) view on the most relevant knowledge about the topic at hand. The author(s) or EURAD assume no responsibility or liability for any errors or omissions in the content of this document. The information contained in this document is provided on an "as is" basis with no guarantees of completeness, accuracy, usefulness or timeliness.

This project has received funding from the European Union's Horizon 2020 research and innovation

EURAD KM documents

7 Themes (level 1)	Theme Overview
79 Domains (level 3)	Domain Insight
79 Domains (level 3)	State-of-Knowledge
Subset of a Domain (100s)	State-of-the-Art

Knowledge Base (Paper, Reports, ...) (>thousands)

DOMAIN INSIGHT PRODUCTION

[3.1.1 Spent nuclear fuel; domain insight]

21 EU Member States manage about 59 000 tHM of spent nuclear fuel used in previous and current nuclear power generation and research activities. Each year, about 3200 tHM of additional spent fuel is generated. The majority of the EU Member States plan to dispose of their spent fuel directly, in a deep geological repository. To bridge the time gap up to the availability of disposal facilities, many EU Member States are making available increased storage capacity for many decades longer than initially foreseen (and licensed) when the first interim storage facilities were commissioned, spanning up to more than 100 years (IAEA, 2019). Nuclear fuel is not designed to incorporate any specific features or characteristics that facilitate direct disposal, but 40 years of research have shown that it possesses important safety functions, allowing for safe direct disposal if packaged in suitable containers that are part of a well-designed disposal concept.

KEYWORDS: spent fuel, burnup, linear power, irradiation history, radionuclide inventories, fuel matrix, grain boundaries, cladding, durability, leaching, radiolysis, radiation damage, helium production, hydrogen.

KEY ACRONYMS: Spent Nuclear Fuel (SNF)

Contributing authors: Bernd GRAMBOW; Paul CARBOL; Johan ANDERSSON; Reviewers: Name.

- **Involvement of the EURAD community** (experts) + "external" experts as knowledge providers is crucial
  - Authors
  - Reviewers
  - Editors
  - Updating

LESSONS LEARNT FROM KM DOCUMENT PRODUCTION

- Identification and engagement of experts is one central pillar for the production of the KM documents … **but challenging**

  - **Timely identification and engagement of high-level experts** (involving the entire community)

- EURAD community **does not cover** the required expertise in all Domains

  - **Identification and engagement of external high-level experts**

- Due to that vast number of different organisations and their different backgrounds → **slightly different views** on the scope and content of the documents

  - Collect broad feedback → all voices to be heard (and NOT only the loudest) and a representative overview of opinions is formed when discussing specific issues and future work

  - Moderate discussions & keeping content on a **generic level** and/or **cover all points of view**

  - A consensus that satisfies everyone to a hundred percent may not be found

- The implemented agile **learning-by-doing** approach has its own challenges

MAKING KNOWLEDGE AVAILABLE - SCREENING AND REVIEW OF EXISTING KM SYSTEMS AND TOOLS

- Development of a Knowledge Management System (KMS) – easy and efficient access to Knowledge

- The aim of KMS is not only to be a digital tool but also a "lively instrument"

- Deliverable D11.1 → 11 organisations were surveyed

Surveyed organizations

RE 9%
TSO 36%
WMO 55%

WMO ■ TSO ■ RE
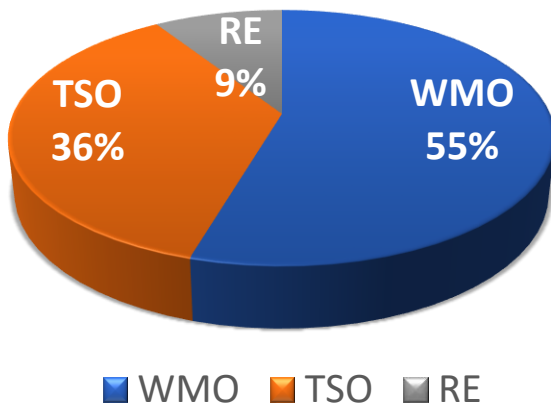
Existence of KMS in the organisation

No 9%
In progress 36%
Yes 55%
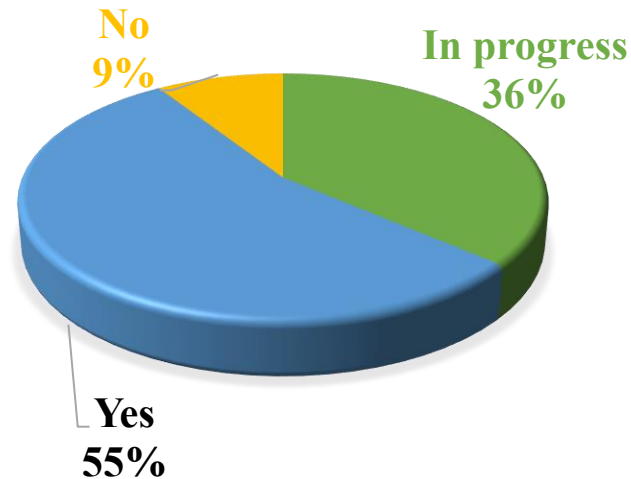
Access to the KMS in organisations

External users 18%
Internal users 82%

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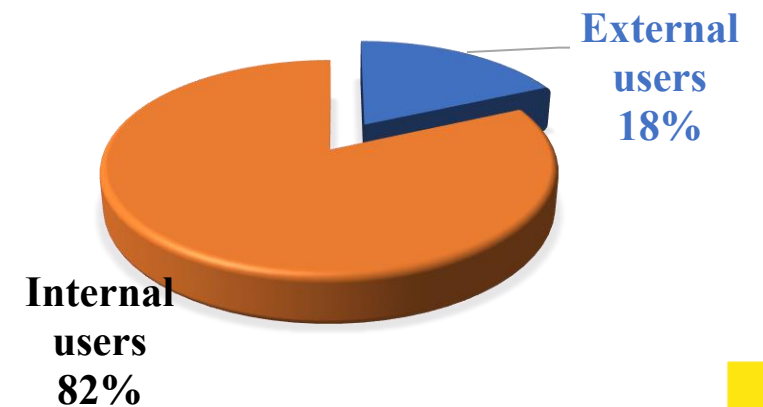
MAKING KNOWLEDGE AVAILABLE - SCREENING AND REVIEW OF EXISTING KM SYSTEMS AND TOOLS

Application of critical knowledge capturing tools by RWM organizations
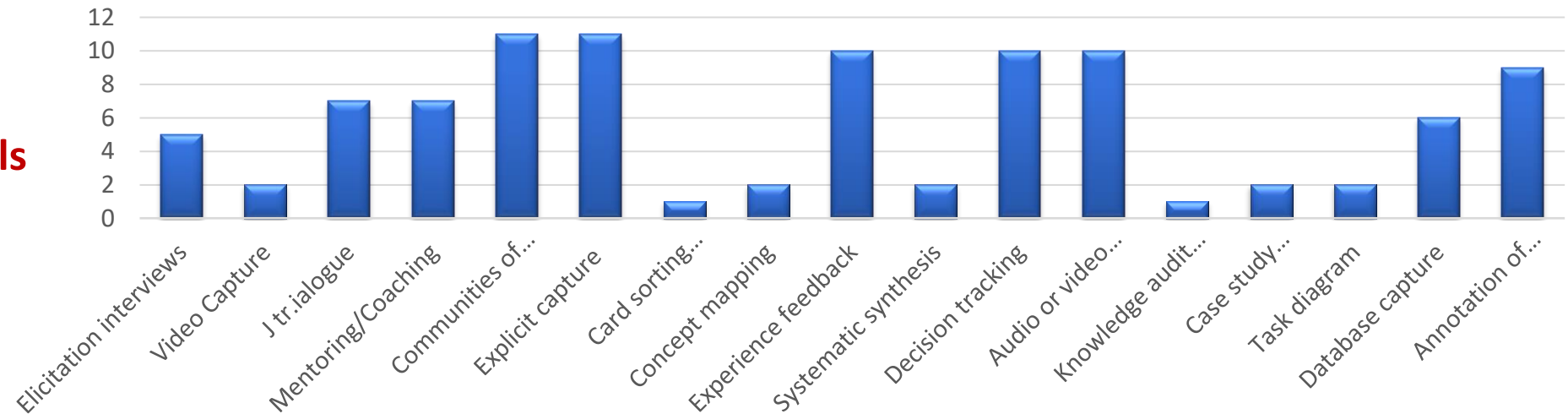
Utilization of IT support system and tools
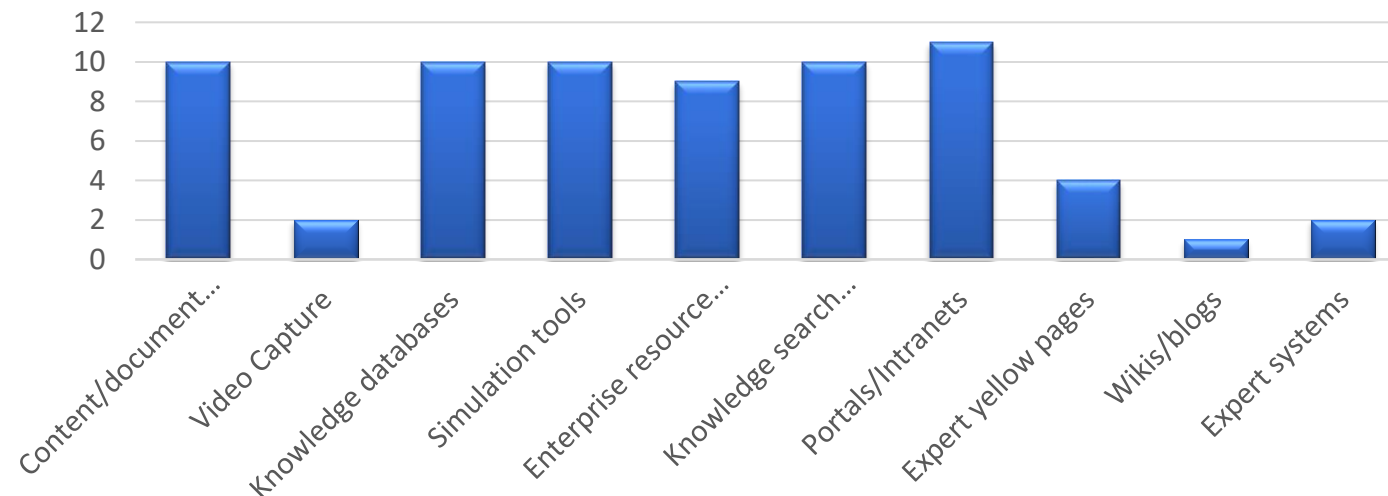
LESSONS LEARNT - SCREENING AND REVIEW OF EXISTING KM SYSTEMS AND TOOLS

- Existing tools are **very diverse** and are adjusted to the respective organisational needs → no clear tendency how the KMS are set

- Portal-KMS should allow storing different types of information in various formats

- A „**forum**" – feedback and comment tool are essential for the portal-KMS

- **Statistical data** should be available to be collected and analysed

- End-users would like to have **a knowledge map** and to know a **Knowledge Champions** of the EURAD community

- All organizations mentioned that **written strategy** and clear policy are essential for implementation of KM strategy in their organizations

- Organisational culture is important for a KMS implementation → **knowledge sharing** is essential

- EURAD KMS is planned to be generalized, web-based, supporting K capture, storage, sharing and transferring

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MAKING KNOWLEDGE AVAILABLE – THE EURAD WIKI

WHY WIKI

- **Most people are familiar with a Wiki (Wikipedia)**

    → **easy to use, end-user friendly**

- **"Easy" to set up and edit**

    → **EURAD community + external experts as contributors ("Wikipedia mindset")**

- **High degree of flexibility**

    → **adaptable to EURAD structure and needs**

- **Simple and affordable IT**

    → **Can be maintained by many people (flexibility), simple systems break less often**

WHAT IS IN THE WIKI?

- **All KM documents structured with GBS**

- **SotA Reports**

  - To be linked to relevant domains, R&D WP input needed
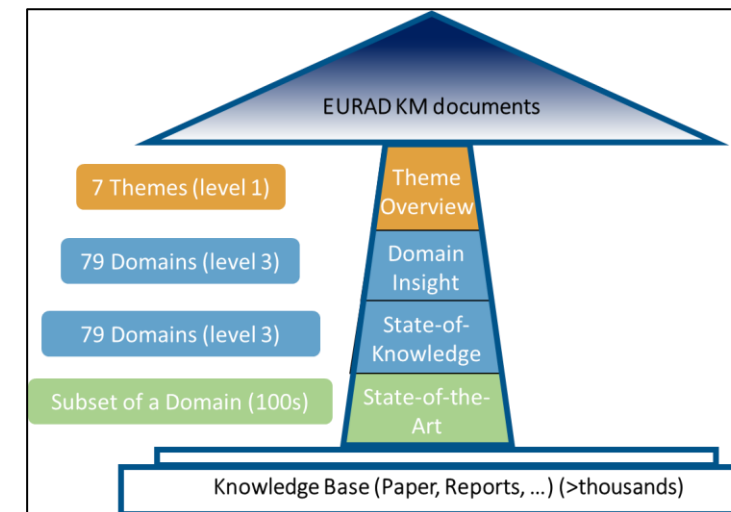
EURAD SotA Reports - The State-of-the-Art [edit]

In addition to the documents of the GBS (Theme Overview, Domain Insight, State-of-Knowledge), the EURAD R&D Work Packages are also producing detailed State-of-the-Art reports about the topics of their work. The WPs produce one intial report at the beginning of EURAD and one final report at the end of EURAD. Check out the following openly available reports (left click on the link will open an external website in this window):

- State-of-the-Art report on **Cement-Organic-Radionuclide Interactions - WP3 CORI**, initial SotA report⧉ or read the WP3 CORI initial SotA - Summary and use the "Discussion function" there to discuss the document (Button at the top left)

- State-of-the-Art report on the **Fields of Numerical Analysis and Scientific Computing - WP4 DONUT**, initial SotA report⧉ or read the WP4 DONUT initial SotA - Summary and use the "Discussion function" there to discuss the document (Button at the top left)

- State-of-the-Art report on the **Understanding of Radionuclide Retention and Transport in Clay and Crystalline Rocks - WP5 FUTURE**, initial SotA report⧉ or read the WP5 FUTURE initial SotA - Summary and use the "Discussion function" there to discuss the document (Button at the top left)

- State-of-the-Art report on **Gas Transport in Clayey Materials - WP6 GAS**, initial SotA report⧉ or read the WP6 GAS initial SotA - Summary and use the "Discussion function" there to discuss the document (Button at the top left)

- State-of-the-Art report on **THM Behaviour of i) Buffer Clay Materials and of ii) Host Clay Materials - WP7 HITEC**, initial SotA report⧉ or read the WP7 HITEC initial SotA - Summary and use the "Discussion function" there to discuss the document (Button at the top left)

- State-of-the-Art report on **Spent Fuel Characterization and Evolution Until Disposal - WP 8 SFC**, initial SotA report⧉ or read the WP 8 SFC initial SotA - summary and use the "Discussion function" there to discuss the document (Button at the top left)

WHAT IS IN THE WIKI?

- **All KM documents structured with GBS**

- **SotA Reports**

  - To be linked to relevant domains

- **Guidance documents**

- **Mobility & Training**
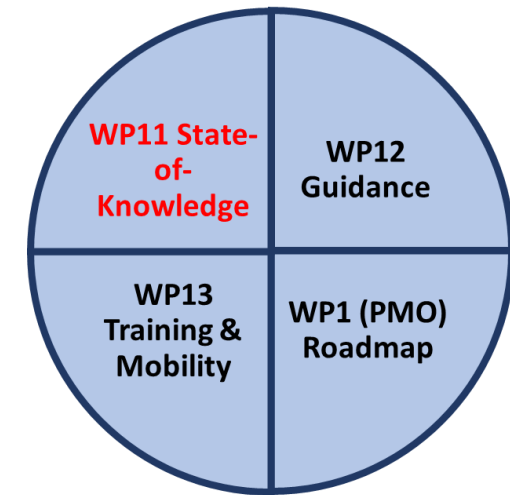
EURAD Guidance documents (WP12) [edit]

In addition to the documents that capture the current State-of-Knowledge, EURAD is also procuing Guidance documents (WP12). These documents will be integrated into the GBS at a later stage. For the time being:

- Click here to read the latest **Guidance document on "Cost assessment and financing schemes of RWM programmes"** ⧉

EURAD Training & Mobility Programme (WP13) [edit]

Are you interested in a training or mobility activitiy and want to know how to get EURAD support?

- Check out the **EURADSchool website** to learn more (WP13 Training&Mobility) ⧉
- Here you can find templates for training ⧉
- Information on what WP13 can do for other WPs ⧉
- Overview of historical training courses ⧉
- Or read on of the published EURAD Mobility Reports

WHAT IS IN THE WIKI?

- **All KM documents structured with GBS**
  - Theme Overview
  - Domain Insight
  - State-of-Knowledge

- **SotA Reports**

- **Guidance documents**

- **Mobility & Training**

Everything in one place!
+ flexibility for more

EURAD Wiki

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Main page | Discussion

Read | Edit | View history | ⭐ | More ⌄

Search wastebook

Main Page

Welcome to the EURAD Roadmap Wiki!

This Wiki is still under Construction! All Feedback and comments highly appreciated! For Feedback, use the discussion function here, or E-Mail us directly at EURAD WP11 SoK: alexandru.tatomir@bge.de and/or tobias.knuuti@bge.de

To get an idea of the overall concept, check out the best developed hierarchy line Theme 3: Engineered Barrier System - Sub-Theme 3.1 Wasteform - Domain: 3.1.1 Spent nuclear fuel (SNF) (including the State-of-Knowledge document on Spent Nuclear Fuel. It includes the Theme Overview, Domains Insight, and State-of-Knowledge document.

For a external visitor of this wiki
Hello, we are still working on this Main Page, so this wiki remains private until it is ready. So please check this page again later!

Thematic Goals Breakdown Structure (GBS) [edit]

A generic roadmap for implementing radioactive waste management, leading to geological disposal

Want to learn more about the Goals Breakdown Strucutre (GBS)/Roadmap? Maybe this video from the EURAD Homepage will help.

The roadmap describes typical programme goals, activities and capabilities needed against 7 themes, which are each further broken down into sub-themes and domains in what we call the "Goals Breakdown Structure (GBS)". This matrix of phases vs. thematic goals provides a tiered and common framework allowing users to 'click in' and access existing knowledge. It is goals oriented to knowledge and competencies most critical for implementation, aligned to the EURAD Vision.

- Theme 1: National Programme Management
- Theme 2: Pre-disposal
- Theme 3: Engineered Barrier System (Draft version)
- Theme 4: Geoscience
- Theme 5: Design and Optimisation
- Theme 6: Siting and Licensing
- Theme 7: Safety Case

Show a list of all Domains (Quick access)

What is new?

If you want to learn more about the EURAD Roadmap: The **Roadmap User Guide (Issue 2)** can be found on the **EURAD homepage Roadmap section**. All finalised and published EURAD KM documents will also be available to all (also external viewers) on the **EURAD homepage Roadmap section**.(These links will by default open in this tab. Open in new tab or window to keep the Wiki open)

If you want to dicuss and comment in documents or the Roadmap, we invite you to use the discussion function in this Wiki (see button at the top) or got to the external EURADSCHOOL discussion board for the Roadmap and EURAD activities (this link brings you to

CONCLUSIONS AND OUTLOOK

- **Knowledge Management is crucial for the safe implementation of RWM**

- **Challenges of KM, e.g., useful structuring of knowledge into topics, providing knowledge on the needed level of detail**

- **EURAD programme is an excellent opportunity to tackle these challenges by bringing together a vast number of organisations and highly qualified experts from different fields**

- **WP11 SoK has taken important steps in the endeavour to capture relevant knowledge and make it accessible to end-users**

  - KM Document production has started and it is ongoing

  - KM Wiki was developed, now accessible in EURAD and allows sharing & discussing

  - Crucial groundwork for the development of a KMS / IT-Platform, was laid through the survey of existing tools and approaches

- **Remaining challenges: extending KM beyond EURAD (in time and to other communities), keeping content up to date, supporting national programmes in the implementation, ensuring usefulness for the end-users**

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CONCLUSIONS AND OUTLOOK

- Population of the Roadmap/GBS and Wiki with KM documents

- Further development of the Wiki

    - →**Involvement of end-users** : exchange and commenting between end-users through discussion function

- Create a **lively KM culture**

- Development of a KM IT-tool based on the needs and specifications identified

- Establishing a **pilot KM Community of Practice** with a significant involvement of the EURAD community

- KM is a **long-term activity** and we look forward to interact with you as …

    - End-users: take a look and please provide feedback

    - Knowledge owners and providers: support the production of the KM documents, indicate relevant sources, and participate in networking

    - Reviewers: review some of the KM documents

- **It is a team effort!**

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THANK YOU FOR YOUR ATTENTION

On behalf of WP11

Alexandru.Tatomir@bge.de