Deliverable 11.1:

Screening and review of existing/available knowledge management approaches and/or tools

Work Package 11 State-of-Knowledge

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Executive Summary

Safe management and disposal of radioactive waste relies predominantly on state-of-the-art knowledge. This is reflected in a strong commitment of EURAD to enhance knowledge management **(KM)** and transfer between organisations, member states and generations. To this end, the current state-of-knowledge **(SoK)** on relevant radioactive waste management **(RWM)** topics will be compiled in user-friendly (foremost easy and clearly explained access modes as well as feedback opportunities) documents and made accessible for all stakeholders in member states' national RWM programmes, including the interested public.

Task 1 within EURAD WP 11 (State-of-Knowledge) deals with the screening and review of existing KM approaches and tools that have been developed for similar purposes. The screening of currently used KM systems in the RWM field (and beyond) collects information on their typical functionalities and consequently identifies helpful aspects for the development of the EURAD KM system **(KMS)**. This includes lessons learnt and best practice. The review outcome thus helps to shape the functionality of the envisaged KMS. It also points to pre-existing implementation strategies and tools to set up this KMS, to establish procedures to document the SoK in a given topic, and how it can be regularly revised in order to integrate new knowledge. The quality assurance of both, the SoK review process and the finalization of SoK documents will be described in detail in D11.5. Moreover, experiences made with similar approaches by other organisations and in other areas will subsequently allow formulating and exploiting the added value of establishing a specific Portal-KMS developed in EURAD and dedicated to provide transnational access to SoK in the field of RWM.

This deliverable D11.1 is based on an iterative development of a questionnaire to screen current KMS and their capabilities. It is split into two parts to address more specifically the different communities of (1) users and (2) developers / administrators / maintainers. In addition, follow-up interviews were carried out to clarify some of the received answers and to establish closer contacts with these KM groups. The collection of the extensive responses and their following aggregation allowed deriving conclusions on the current state-of-the-art of large scale KMS implementation, namely in the areas of nuclear science and technology. Most important for the further establishment of a EURAD KMS are the following points:

1. A clear policy & strategy in KMS development and implementation will avoid many traps and pitfalls so far encountered by the organization, and will increase the chances for high usage and sustainability. Do not repeat the lessons already learnt by other organisations!

2. The EURAD KMS will generate significant and long-lasting impact only if there is a correct understanding of KM as an added value for organizational assets. To ensure these effects, the organization operating the actual KMS shall be sustainable, i.e. having enough resources and a clear dedication to this task ideally for several decades.

3. An organizational culture is extremely important for KM implementation. This addresses not only the access modalities but also the potential of interactive usage. The essential part of successful KMS is knowledge sharing. The stronger the trust factor in an organization the

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more easily knowledge will be shared. Eventually, this strongly promotes the active usage of the KMS.

4. The participating organizations expressed their expectations that the EURAD KMS shall provide assistance of managing distinct knowledge and information types for implementation, sustenance and preservation of critical nuclear knowledge for safe and efficient managing of radioactive waste. All surveyed organizations consider KMS essential for their organization and are expecting assistance and support in KM from EURAD, implicating unlimited access to a well maintained, sustainable portal-KMS.

5. A set of specific elements of functionality required to create an interactive, easy to use and maintain, and thus sustainable KMS was derived (specification record).

6. Already available modules of other organisations will be checked for their suitability to become a useful component of such a EURAD KMS by matching it against the above mentioned list of functionality elements. In such a way, cost efficient and rapidly ready solutions for the prototype development are possible. A list of useful WWW references to already existing KMS packages and codes (or components thereof) was extracted from the questionnaire responses, see Annex A. This set of KMS packages or codes currently comprise of 13 items, all of them being either professional KMS systems adapted to the specific needs of an institution, or in-house engineered solutions building on commercially available components. Simple Wiki-based approaches or repositories, however, have not been used or considered as an efficient KMS by any of the organization questioned. So such approaches eventually cannot replace a KM system.

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Glossary

The following are common terms to be used globally in the context of the EURAD Roadmap. They are specifically adapted for and directly linked to EURAD Knowledge Management and might thus deviated from definitions used in other communities.

Communities of Practice (CoP)

A voluntary group of peer practitioners who share lessons learnt methods, and best practices in a given discipline or for specialized work. The term also refers to a network of people who work on similar processes or in similar disciplines, and who come together to develop and share their knowledge in that field for the benefit of both themselves and their and other organization(s).

Critical Knowledge

Knowledge established in the context of a particular position that is deemed imperative for incumbents of said position to possess before being allowed to perform associated duties and tasks independently.

Domain

An area of activity, interest, or knowledge, especially one that a particular person, organization etc. deals with. Also referred to as 'Topic' or 'Knowledge Area'.

Domain Insights

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.

Goal Breakdown Structure (GBS)

The EURAD goal breakdown structure is a functional-oriented breakdown of knowledge essential for implementing radioactive waste management, leading to geological disposal. Currently the updated Strategic Research Agenda of the established EURAD programme comprises a hierarchy of Themes (Level 1), Sub-themes (Level 2) and Domains (Level 3) containing Domain Insight, SoK and SoTA documents.

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 base

A knowledge base is a collection of knowledge in the form of subject-problem-solution information that pertains to a specific topic or subject of interest. A knowledge base is a special kind of database for knowledge management.

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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.

Knowledge Management System (KMS)

Knowledge Management System (KMS) is an IT-infrastructure designed for supporting the KM-process by tools and technologies for management of knowledge and information.

Metadata

Means descriptors, which define and describe the data and the circumstances of their creation (date, persons, locations, institutions, treaties, liabilities, storages, access modes etc.)

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.

Roadmap

A generic RWM framework to organise different typical scientific and technical domains and sub-domains in a logical manner against different phases of a RWM programme.

Portal

A portal is a tool to integrate many existing systems within an organization as well as to provide a solid platform to develop other knowledge management initiatives, enhancing the efficiency of communication and of organizational processes. A portal greatly facilitates the production, accessibility, sharing and effective use of valuable information. It also guarantees generation and usage of information at different times or across different locations and teams.

State-of-Knowledge (SoK)

Experts' view of the most relevant knowledge and associated uncertainties in a specific domain/sub-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.

Strategic Research Agenda (SRA)

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

Themes

Themes are large groupings of related Knowledge Domains typical in Radioactive Waste Management. They are the highest level of the EURAD Roadmap work breakdown structure.

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

Knowledge is crucial for the safe management and disposal of radioactive waste. The European Joint Programme on Radioactive Waste Management (**EURAD**) will generate and manage knowledge to support EU Member States with their implementation of the Waste Directive (EC 2011/70/EURATOM), taking into account the different stages of member states' national programmes. EURAD has the potential to identify and compile critical knowledge, address this properly in respective knowledge management **(KM)** tasks, and provide European added value, by accessing organisational and expert tacit knowledge and codifying it to support knowledge transfer between programmes, member states and generations. For both, a systematic approach of establishing the current state-of-knowledge and its transfer to the end users in the field of Radioactive Waste Management **(RWM)** is urgently needed. End users are described in D11.5 and in the EURAD Roadmap Guide.

It was the vision of the EU project JOPRAD to establish an integrated knowledge management system and implement it on a European level. Thereby, present and future waste management programmes shall be supported, and the next generations shall benefit from the knowledge generated through past, on-going and future RD&D programmes and associated activities. However, until now, there is no unified approach to KM within the RWM area, neither in Europe nor globally. The huge amount of knowledge acquired in the past 3 to 4 decades is distributed over many local repositories within possibly hundred or more institutions and it is currently present in different formats (sometimes not even digitized at all). Consequently, this knowledge is scattered, and difficult to identify, track or access. Coupled to that there is also a lack of generally accepted quality criteria, review procedures and storage systems. Abstracting and keywords are not in a unified system, either. In addition, as was commonly agreed upon as an outcome of the JOPRAD project (GA653951) preceding and triggering EURAD, structuring of all the RWM-related knowledge was also in a rather infant state at the start of EURAD.

When setting up EURAD, a way to improve this situation was drafted. As this is work in progress and in general a dynamic/complex field, details might still be adapted to allow development. However, there is a certain order of actions already identified and agreed upon, with the following major steps (mostly to be dealt with by the PMO/WP1 and WP11). And it should be noted here that there are activities stretching well beyond the current run time of EURAD-1 – as knowledge generation is still (and will continue) progressing at impressive speed. Consequently, the KMS will reflect these dynamics and shall be adaptable to future needs, ensuring beneficial usage (and proper maintenance) for the next decades to come. The identified actions are:

1. Clearly defined knowledge organizational structure
2. Develop a descriptive categorization scheme each built on its own set of documents: Theme Overviews, Domain Insights **(DI)**, State-of-Knowledge **(SoK)**, State-of-the Art **(SotA)**.
3. Generation of a first representative set of the above documents, which will be made available to EURAD-internal test users to obtain first feedback to improve processes & documents for greater end-user benefit. Generation of these documents will be ongoing in parallel to the following steps.

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4. Develop a keyword / label system for RWM knowledge (in parallel to the previous item) and then tag knowledge documents accordingly.

5. Define (and rank according to importance for usability and sustainability) capabilities of a commonly accessible digital knowledge management system **(KMS)**, the portal-KMS, and issue a respective specification report.

6. Design such a KMS and test a prototype.

7. Implement the portal-KMS in a tiered approach.

8. Transfer Theme Overview, DI, SoK, SotA documents into the KMS (population step 1).

9. Transfer further knowledge packages (from primary sources) into the KMS (population step 2).

10. Improve the KMS by recognizing experiences and user feedback as well as changing needs.

This report primarily deals with item 5 of the above list to lay solid foundations for the items 6 and 7. The capability request identification (based on a questionnaire and being part of this deliverable) is done in parallel to the initiation of a prioritised programme of SoK and Domain Insight production. The main target is to support the finding of a common view on the best practice for the EURAD KM approach on a basis as broad as possible. This eventually will produce a respective specification report.

The development of such a specification report is again divided into various steps. It is crucial to have a very profound knowledge about various existing KMS first, ideally with direct relations to at least some aspects of RWM. Then, experiences and lessons learnt from implementation and usage of such KMS are of great value. Ideally, this shall provide recommendations for tools already on the market that can be used to establish a matured KMS at relative low costs.

In order to reach the above target, a screening and review of similar approaches to KM by a variety of national and international organisations was performed. With the help of a questionnaire, existing programmes, systems, instruments and databases to map knowledge and to make mapped knowledge easily available were evaluated. To achieve this the EURAD community was asked for feedback. From the very beginning, it was clear that the request for information has to be well structured and formulated, thus an iterative approach was favoured. Details are outlined in the next chapter.

Further contributions to the KMS design will come from mapping the existing global state-of-knowledge relevant to RWM (using expert views). Here, EURAD will identify gaps in knowledge codification and subsequent knowledge management needs. Gaps identified for SoK documents will be evaluated with regards to suitability for addressing within EURAD and prioritised within the future EURAD KM programme (or if it should be covered elsewhere, e.g. IAEA or OECD/NEA).

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2. Questionnaire Template

A first questionnaire draft was composed and submitted to the Programme Management Office (PMO) for a pre-review in August 2019. That questionnaire was intended to provide essential input to task 1 "**Screening and review of existing/available knowledge management approaches and/or tools**" of EURAD WP11. In consideration of the received feedback, the questionnaire was then further refined and updated. Namely, the questionnaire was split into two sections. They specifically address: (1) users and (2) maintainers of knowledge bases and allowed the involvement of different persons when answering the questionnaire, i.e. by bringing in additional experts from each organisation. Both parts of the questionnaire start with a respective preamble as follows:

"Within EURAD focussing on radioactive waste management (RWM), the Work Program 11 (WP11) - Knowledge Management is – as one important, novel and ambitious component - developing a systematic approach of establishing the state-of-knowledge (SoK) and its transfer to the end users in the field of RWM research. It is aimed that the aspired KM tool/system should not only be a digital tool but an instrument in which the participating actors actively share their knowledge.

SoK has two elements: (i) developing (short) documents for themes/domain/sub-domains that describe the state-of-knowledge by experts and contain a few signposts to important reports existing within the EURAD community or elsewhere and (ii) a more detailed mapping of important reports onto themes/domain/sub-domains that can be easily found and retrieved by end users.

The questionnaire below is dedicated to a screening and review exercise of existing programmes, systems, instruments and databases to map knowledge and to make mapped knowledge easily available. It is designed to collect their inputs/lesson learnt and best practices for similar purposes. This should help to obtain an overview of currently available/used KM systems (not limited to the nuclear sector) and fused them together to a suitable KM system for the EURAD community.

The questionnaire is split into two parts: Part I is primarily addressing those KM specialists (management experts, administrators) from specific EURAD WMOs/TSOs and also from international organisations that are expected to have ample experience in respective KM policies, architectures/systems (also in administrative design and operation) and their application related to nuclear waste management. Part II aims more on those experts that set-up the KM systems and keep them running, i.e. represent a more technical point of view, but also people who already have experiences in accessing and using KM systems. From that point of view, it would be helpful to carry out the interview with two persons, i.e. one administrator type and one user type.

The complete questionnaire will be distributed to selected (by the PMO) organisations (with two or more contact persons identified beforehand). These contact persons then are expected to read this questionnaire and prepare for an interview with members of the EURAD WP11 team – ideally through one (or two, if some questions require an additional information survey) video/teleconference. The interview will be recorded and transformed into respective minutes that are send back for correction, amendments and approval by the interviewed person. Eventually, all minutes will be assessed/analyzed

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by the WP11 team and contribute to the KM SoK definition, the set-up of the KM tool and finally also to its installation and population steps.

ATTENTION: A short note at the end: please feel free to interpret all questions in an open manner. If you feel that some of the aspects, you would like to mention do not fit into the pre-defined structure of this questionnaire please add respective lines at the passages that seem most appropriate for you."

The questionnaire was distributed to all organisations being partners within EURAD WP11, WP12 and WP 13, i.e. the knowledge management related community at large. As not all of them accepted this invitation to contribute / comment on the questionnaire, the list of responding organization as given in table 1 contains 11 entries. As it covers well-acknowledged large national WMOs, TSOs and REs, it certainly can be considered as representative. In October 2019, it was also decided for the application of the two-section questionnaire to pursue a tiered strategy. It consists of: 1) disseminating the questionnaire to selected contact persons (from EURAD beneficiaries as outlined above) with extensive explanations attached and 2) bilateral discussions/interviews in form of a video or phone conference between those representatives of the approached organisations that actually delivered the answers, and the WP KM SoK team responsible for the questionnaire. This approach was first tested with Andra. The outcome then allowed for further improvements of the whole process and more specifically for several questions. The received answers of the first group of surveyed organisations showed that some questions were not clear and needed to be improved. Thus, the questionnaire was updated. The newly added and revised questions were again sent out to the first group and their answers were collected in a similar manner as before. In addition, the revised and improved version of the two-section questionnaire was then distributed to another group of KM experts. See table 1 below for a list of all institutions responding to the questionnaire during the two stages of request. So far, all these responses (in form of written answers to the questionnaire and by follow-up telephone interviews) were collected to compile Deliverable 11.1

Table 1 – EURAD participants having responded to the KM SoK questionnaire (as of January 20, 2021).

Acronym	Full name of institution	Category	Country
ANDRA	Agence nationale pour la gestion des déchets radioactifs	WMO	France
Bel V	Belgian Agency for Radioactive Waste and Enriched Fissile materials	TSO	Belgium
CIEMAT	Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas	TSO	Spain
GRS	Gesellschaft für Anlagen- und Reaktorsicherheit GmbH	TSO / RE	Germany
JRC	EC Joint Research Centre	RE	EU
Nagra	Nationale Genossenschaft für die Lagerung radioaktiver Abfälle	WMO	Switzerland
PURAM	Public Limited Company for Radioactive Waste Management	WMO	Hungary

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RWM	Radioactive Waste Management	WMO	Great Britain
SKB	Svensk Kärnbränslehantering AB	WMO	Sweden
SSTC-NRS	State Scientific and Technical Center for Nuclear and Radiation Safety	TSO	Ukraine
SÚRAO	Správa úložišť radioaktivních odpadů	WMO	Czech Republic

The full text of the questionnaire template, i.e. a compilation of both parts (without the preamble) is added as annexes B1 and B2, respectively, to this report. The next chapter summarizes the answers received. Here it should also be mentioned that free text answers were asked for in Question 2 (Q2) and could be provided in the comment fields added to many of the questions, too. Standard case, however, was the offer to select from a variety of pre-defined options. This also applied to Q10 from part II where a conventional table was provided to hold the large number of options.

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3.   Aggregation of responses obtained to the Questionnaires

Each question is dealt with separately, with the respective number in front. Q1 was asking (in both parts of the questionnaire) for the contact details of the person interviewed and is thus not given here. In the following section not the verbatim responses from the organisations are given, but an aggregated compilation of all received answers with interpretation by the authors of this report.

3.1 Part I – User Communities (General questions)

Q2. What are the minimum requirements of a EURAD KM from your perspective with respect to organisation and policy to share and develop knowledge? Your answer should (a) provide a clear definition of components and system, (b) address the interfaces between the components and (c) describes the roles and possibilities of contributing actors and how they could benefit.

(a) KMS preference is to be integrated in a digital web-based platform, offering users knowledge management and collaboration tools, which involves governance, process, people and technology. It should not only allow users to search and access various types of knowledge products, but also to allow commenting, to provide feedback and to contribute to the development of suitable knowledge products. It was advised to take into account new developments related to data mining and artificial intelligence. To render the whole system more interactive (and thus increased usage) it was recommended to establish a formal "master user", i.e. a content curator who could respond/answer to participants' queries and who would be responsible to upload new documents. Such a curator could be in fact a group of several people. It is recommended by the surveyed experts to put an organisation behind and not only install a digital system.

Concerning the content, there should be SoK documents related to specific themes, domains and sub-domains (as defined in the EURAD Goals Breakdown Structure (GBS)), SotA reports related to specific EURAD RD&D WPs, other documents (information) related to Strategic Studies WPs, the PLANMAN Guide[1] and other RD&D Guides, as well as information related to training and mobility. It could be structured in different ways e.g. in safety functions, by type of materials, or component/structural unit. Minimum requirements of such a KM tool would be to provide guidance to organizations with respect to RWM KM issues, resources should include sample policies, defined roles and an advanced roadmap. It also turned out that the surveyed organizations see a major advantage in harmonizing respective efforts of EURAD, IAEA, and OECD/NEA to generate such a KM tool for radioactive waste topics.

(b) As known, KM fundaments consist of three main components: people, processes and technology. People are the most important factor in knowledge creation, sharing and dissemination. IT tools support people in storage and preservation of knowledge.

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[1] This Guide will be published in frame of EURAD

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Organizations are expecting that EURAD KMS will act as a knowledge broker. This could also comprise direct interactive collaborative activities between people. Here, the provision of push and pull interfaces (people-document) in order to manage information is expected. The interface could be rather simple, the less tabs the better. It should have a detailed search filter dependent on criteria (type of publication, topical areas and subjects, public/restricted access, RWM stages, keywords, etc.). The interface could also contain a tab for users to upload documentation. The above-mentioned curator can then check them and decide whether to include it in the database or not. Such a collection and analysis of feedback would also allow for gap analysis and further strategic improvements. The system should be scalable, flexible to store different types and formats of information (including metadata) extensible and collaborative. It is suggested not to duplicate information already available on other platforms (e.g., implementers' websites, OECD/NEA, IAEA) but rather to reference to them. The interface should integrate procedures and arrangements for interaction between the content documents (hierarchy of the documents, hyperlinks, system update after uploading new documents, etc.), i.e. for the user navigation within the KMS with all the necessary manuals available.

(c) EURAD KM could provide guidance and a framework. RWM organizations could contribute with their experiences in developing their KM and regulators could share their relevant experiences with their national regulations. A priori all actors can participate. Each actor can benefit from developing their own KM tool/system and through establishing harmonized KM practices, roles, policies throughout their partner organizations/institutions through common understanding and definitions. The review of the knowledge should involve all types of actors to avoid "biases" in term of points of views. The managed knowledge should not include interpretation about impact on safety. This is something to be done at the national level to ensure independence between the actors. Continually provide knowledge preservation and transfer via generations. Roles and possibilities of contributing actors shall focus on sharing and exchange of knowledge. Users can access all information and can share their own information if the curator decides so. There should be several groups of contributing actors, like currently being established within the KM SoK: 1) expert groups (authors) to work on preparation of specific knowledge products, which may involve SotA contributions from EURAD WPs; 2) independent reviewers for major/significant knowledge products to ensure their quality; 3) the final approval group (possibly EURAD PMO / Bureau). Comments/contributions from external actors should be considered as well (e.g., different/deviating/complementary views) and for them a suitable forum/platform should be established in which their comments/suggestions are evaluated by a curator and if considered useful further processed. Other important groups are the developers of KMS and supporting staff.

Q3. What structural types of information should the EURAD KM system contain at the first stage, i.e. within the first two years?

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Strongly preferred were reports, followed by scientific papers and presentations. Less often mentioned were announcements & schedules (courses / classes), or workshops (announcements / learning materials).

Q4. Do you think that it is necessary to have the architecture of the KM system in a matured form before populating it with content?

Half of surveyed organizations answered with "yes" and the second half answered with "no". It was suggested that the population of the KMS could be done progressively, but at first a clear vision of the target system has to be defined. Subsequently it has to be prioritised which components should be addressed and when they should be implemented, depending on importance (for the users) and technical effort (IT). For instance, content access has to be implemented first and social media functions at a later stage (only as an example). Also, use "agile" methods to define, test and deploy the various components. Populating a system which is still under development often results in extra work and could potentially result in "patchy" content, as content have to be reviewed/updated every time the architecture of the KMS is updated (e.g. change of metadata, file format, etc.).

Q5. For the digital KM tool: which input formats of the documents would you prefer?

There is a clear preference to present the material as PDF and MS Word documents. Next in list are XML, HTML. It was mentioned that all listed tools can be used for KM, but for long-term preservation of knowledge, the PDF format was most desirable.

Q6. For the digital KM tool: which output formats of the documents would you prefer?

The ranking of advised formats is identical to the one for the previous question. A comment was given as follows: the output format depends on type of data/information that is stored in KMS and the use of the output format. The PDF format is most suitable for sharing documents and presentations, on the other hand, for further edition MS Word would be desirable and for data's transport XML[2] will probably be the preferred format. It is recommended to not restrict the output format and add PDF/A[3] for preservation. In conclusion, the format should be editable for continual improvement and updating.

Q7. Which language specifics of documents in the EURAD KM-System (in addition to the mandatory English documents / translations) do you also consider useful?

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[2] Extensible Markup Language (XML) is a markup language that defines a set of rules for encoding documents in a format that is both human readable and machine-readable. The World Wide Web Consortium's XML 1.0 Specification of 1998 and several other related specifications—all of them free open standards—define XML.

[3] The PDF/Archival (PDF/A) standard aims to enable the creation of PDF documents whose visual appearance will remain the same over the course of time. This standard was adopted by the International Organization for Standardization (ISO) in autumn 2005 and published as 'ISO 19005-1:2005'. INIS considers adopting the standard for achieving efficient preservation and long-term archival of the IAEA and IAEA MS nuclear information resources.

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The majority preferred to have also included the original document provided in the native language. It could be coupled to descriptors, key words and an executive summary (abstract) in English.

Q8. Are you interested in an interactive communication like chat rooms or forums?

A majority answered "Yes". It was annotated, that forums are very useful in order to create communities of knowledge and to give opportunities for users to assess the information provided and to comment on the given document. As example for such an interactive communication tool, the usage of the Moodle tool (https://moodle.org/) was mentioned. At the same place, where all the documentation about Moodle is put, one can access several forums to ask, to comment, and to help others with their requests.

Q9. Would you be interested in collecting and processing statistics of the KM usage, e.g. to identify "hot topics"?

The majority of the surveyed institutions answered "Yes", with the following items specifically addressed: (1) user access (kind of user, user identity, country, institution etc.), (2) topics looked at, most frequently accessed documents, (3) statistics of keywords used for search ("Could be useful in identifying priorities for content update."), most frequently accessed documents, and most often downloaded documents.

Q10. Do/did you extract information from a KM system?

All organisations are actively extracting information from their KMS.

Q11. If yes to Q10: How often on average and what kind of information do/did you extract as an administrative user from a KM system?

Typically, the documentation as well as system's administration usage, metadata and statistics are extracted on a monthly or even more frequent basis. In addition, internal information is tapped that may not be available within the EURAD KM SoK, such as internal guidelines, job descriptions, enterprise standards, reviews, regulatory documents, safety case documents.

Q12. Do/did you feed information into a KM system?

All organisations are actively feeding their KM systems.

Q13. If yes to Q12: What are the sources of the information that you submit?

The two major sources identified are either own knowledge of the organisation or knowledge identified from external sources.

Q14. Do you know organisations/institution/companies - inside or outside of the Nuclear/Radioactive Waste Sector - which might have/using a well working KM system? If yes, please name them.

The following links / packages / tool boxes were explicitly mentioned, they have to be explored in more detail in the upcoming months within task 1:

- IAEA's INIS database https://www.iaea.org/resources/databases/inis

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- JRC data catalogue www.data.jrc.ec.europa.eu
- CIEMAT's institutional repository http://documenta.ciemat.es, however available only in Spanish using an open repository sharing system – Dspace https://www.dspace.com. This is currently the most widely used repository software with more than 2.000 installations around the world. It is open source and completely customizable to fit the needs of any organization. Another option is Open digital repository system linked to https://recolecta.fecyt.es/home (gatherer of national repositories). There is also a document management system, e.g. Alfresco (https://www.alfresco.com) and other databases linking to courses via Moodle and Webcontrol (http://www.webcontrol.es/en), as well as further specialized KM tools only available in Spanish, however.

Q15. From your experience with existing KM systems: What are the lessons learnt? Namely, which drawbacks would you like to see avoided and which good points could be copied by the EURAD KM?

Typical lessons learnt were: long term sustainability of KMS, quality of metadata description, correct name of documents to make it searchable. Also important is to motivate people for contribution and provide incentives to do so. Once the system is running, promotion and explanations (especially trainings/tutorials accompanying "classical" user guides & documentation) to users on how to use the system ("user experience") become essential.

Knowledge is often not static, RWM technologies, methods, regulations change over time. The KMS should consider this aspect. There should be functions to identify earlier knowledge inputs, which turned out to be not up to date or even obsolete and to point to newer information. It was also advised to not restrict usage of the system. Users may find ways to explore and exploit the system in a way that was not the original intention, but still could be very helpful. Dependence of technological platform for long-term preservation has been mentioned as a technical issue, which should be taken into account at development stage.

The most important aspect for such a KM tool is the organisation of content provision (roles, responsibilities, flows, incentives, motivation…). If this is weak, the technical system may fail. A lack of a clear policy for implementation of the KMS and a missing permanent adaptation to the available technical capabilities (different platforms) will reduce usability. A written policy should be developed for implementing a unified strategy of how to design and develop a KMS. Another problem identified is inadequate attention paid to determining risks of knowledge loss, including "hidden" knowledge. This is often combined with a lack of implementation of people-to-people interactions for knowledge transfer. Other drawbacks addressed are the lack of knowledge about existing databases and the practical conditions of using many of them. In addition, inadequate knowledge search capabilities and/or the presence of obsolete information have to be avoided by all means. If end-users are not able to find the wanted information or it is obsolete, then they will start to lose trust in the system and eventually will stop using it. In order to steadily improve the KMS efficiency and usability, a dedicated management has to be provided.

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Strengths named are state-of-the-art information technologies, data always available, competent staff and well-organized internal knowledge transfer processes. Once the system is considered beneficial to users, it becomes self-sufficient and grows on its own.

Q16. What is the expected benefit from the EURAD KM system for your national RWM programme? (max. 10 keywords)

The following keywords were given: Updated information, knowledge exchange, unification of data sources, international outreach, institutionalised KM, preservation of information & knowledge, assistance in KM implementation, dissemination of RWM knowledge & experience, RWM site solutions, access to scientific publications and direct communication. Establishing the SoK and its transfer to the end user in the field of RWM research. The KM tool/system should not only be a digital tool but in particular it should be an instrument in which the participating actors actively share their knowledge.

Q17. Are you willing to participate as an expert/member of a scientific board for the pre-selection of the input documents?

Most of organisations stated their interest to be actively involved in in the preparation of the SoK documents. Only one organisation answered with no.

Additional comments provided:

"JRC were answering the questionnaire by having in mind the overall KMS used in JRC (i.e. not RWM specific). It is very important to note that JRC is not a waste management organisation and their KM needs potentially differ from the RWM organisations, as the JRC approach on knowledge management is mostly driven by their policy support needs."

3.2 Part II – Development / Administration / Maintenance (technical issues)

Q2. Do you already have an existing KM system at your company/institution/organisation?

Most surveyed organisations gave response about KMS in use in their own organisations. There is a clear tendency that larger organisations are more likely in the process of developing KMS. Based on already existing tools, e.g. in house databases or document management systems and available basic experience these organisations are now in the process of integrating these tools with new ideas to set up a suitable KMS. In this process, KMS are based on a systemic approach involving interactions between people, processes and technologies. However, there is a need to design such KMS together with the respective target users. One organization, which so far has no KM tool, is using a document management system instead, in which a relevant project documentation (including project reports) is included. The available documents can be searched by topic, by keywords, and by projects.

Q3. If yes to Q2: How many years ago was the KM system established?

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There is a wide range of starting points for the establishment of a KM tool ranging from more than 10 years to implementation of a KM system right now. The one organisation that so far has no KM system is using a documentation management system, which enables users to search it for topics, keywords and projects.

Q4. If yes to Q2: For what time span of active usage is/was this KM system planned?

All surveyed organisations plan to use their KMS constantly.

Q5 How is your KM system organized?

There is no clear tendency of how the surveyed organizations set up their KMS. Some are organized in a centralized ways and others in a decentralized way. One even describes itself as a hybrid one, i.e. that multiple tools of their KMS are organized in a centralized way but internal reports can be also distributed locally. The contacts to the outside are centralized. Here it has to be clarified which data can be shared with others and which ones are confidential.

Q6. Does your KM system have a central curator who organizes updates and manages its content?

Most surveyed organizations favour a central curator who organises updates and who manages its content. However, it also depends on the size of the KMS. In one organization, some elements of the KMS are managed centrally by a dedicated KM unit and some other elements are managed by topic specific KM units. However, it is difficult to say what is part of a KMS and what is something else, e.g. the IT work of such a KMS which is often carried out from outside by external companies.

Comments: PURAM expected to get a Knowledge Management Assist Visit (KMAV)[4] from IAEA in October 2020, which will define KM roles in PURAM.

Q7. Does your company/institution/organisation have a written policy for implementing its strategy in the KM area?

All interviewed organisations considered a written policy essential for implementing the KM strategy in their organisation. Most of them prepared it already with the exception of two organizations, where the policy development is still in progress. Only one organization has no separate policy for a KM strategy implementation yet, because it has been already included in the general policy of the organisation described in documents of the integrated management system.

Q8. If yes to Q7: is KM policy of your organisation integrated into management system?

Most surveyed organizations have done this already, or are in the process of integrating their KM policy into their own management system.

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[4] https://www.iaea.org/services/review-missions/knowledge-management-assist-visit-kmav

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Q9. Does the strategy of your organization supports continuous learning to improve individual and organizational performance**?**

> All interviewed organizations stated that they support continuous learning to improve individual and organizational performance.

Q10. Is the KM system tool in your organization based on a KM policy?

> All surveyed organizations stated that the used KMS tool in their organisation is based on a respective KM policy. This is achieved by harmonisation of existing tools and used in-house information management procedures and practices with the organisation's KM policy. In addition, the KMS tools have to take into account the information security policy of the respective organisation.

Q11. Do you have experiences with KM systems, which were abandoned?

> There were only two organizations which already had experiences with an abandoned KMS. The majority of the surveyed organisations is working on their first KMS.

Q12. If yes to Q11: Can you name, the reasons why the KM-System was abandoned?

> The organizations, which responded with yes to the previous question, mentioned the following reasons: lack of sponsorship, poorly organised content provision, poor promotion and training, change of the used technical platform, the KMS was not continually updated and poorly moderated. However, they also stated that the reason why the KMS was abandoned was not related to technical problems.

Q13.Does your organisation utilise methods to identify people who have critical knowledge?

> All surveyed organisations (beside one organisation with no own KM) utilise methods to identify people who have critical knowledge. The one organisation, which for the moment does not utilise such methods, has a proceeding to identify training needs to be developed by the workers through a KM division and actively participates in a KM group.

Q14. Does your organisation adopt certain techniques to capture critical knowledge such as (here a number of techniques follow as options)?

> The answers to these techniques are described below. A more detailed description of common techniques to capture critical knowledge, e.g. the ones listed below, is provided by the IAEA NG-T-6.10, and references therein.
>
> *Elicitation interviews* (= a method for gathering detailed and precise accounts of human experience)*:* Only half of the survey organizations carried out elicitation interviews.
>
> *Video capture:* Only one organization used video capture, another one used it only in some cases.

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On the job training dialogue: The vast majority of the surveyed organizations adopt on the job training dialogue as suitable technique to capture critical knowledge. Only one organization used it in some cases.

Mentoring/Coaching[5]: Except for one organization this technique is used by all surveyed organisations to capture critical knowledge. However, of these organizations there is one organisation which is using this technique only in some cases.

Communities of Practice: Half of the surveyed organizations use CoP and the second half plans to use it.

Explicit capture (narrative documentation): Explicit capture is used by half of the surveyed organizations and the second half is planning to use it.

Card sorting (manual concept map): Only one organization is using this technique to capture critical knowledge.

Concept mapping[6]: Concept mapping is only used by two organizations. Another two organisations plan to use it. Most of the surveyed organisations do not use concept mapping. One organization was not responding to this question.

Experience feedback: The majority of the questioned organisations already use experience feedback as a technique to capture critical knowledge. One organization plans to use it in the future.

Systematic synthesis: Only two organizations do apply this technique.

Decision tracking: Decision tracking is used by the majority of the surveyed organizations.

Audio or video recording of "storytelling": The majority of the surveyed organisations used this method.

Knowledge audit method: This method is used only by one organization.

Case study simulation and walkthrough: Only two organisations use it.

Task diagram: Only two organizations use it or apply it in some cases.

Annotation of existing documents, calculations, procedures: The vast majority of the surveyed organizations use this technique to capture critical knowledge. Only two organisations do not use it.

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[5] Coaching, mentoring and job rotation entail the development of a set of practices that help to accelerate learning in the organization and help to mature younger employees at an earlier state. These techniques involve close personal relationships that support communication of implicit and socialization of tacit knowledge.

[6] Tools for organizing and representing knowledge. Concept maps include concepts, usually depicted in circles or boxes of some type, and relationships between concepts or propositions, indicated by a connecting line between two concepts.

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System engineering notebooks: None of surveyed organisation use this technique.

Database capture: Half of surveyed organisation use it.

Other techniques: There was no comments to this question.

Q15. Does your organization have a comprehensive methodology that addresses learning from experience?

Here the majority of interviewed organizations stated usage of comprehensive methodology. Each organization seems to follow their own/individual plan and thus a generalization is hardly possible. One organization tries to train new employees, if possible, by the predecessor. Another organization participates in several programs for "educational collaboration" with vocational training supported by universities and high schools. In these programs, students have the chance of learning by doing for a certain period of time. By offering this program there is the chance for the company to contact and recruit new employees. Only two organizations specified that they have no comprehensive methodology in learning from experience.

Q16. Are self-assessments regularly used to enhance organisational knowledge?

The majority of surveyed organizations use self-assessments to enhance organizational knowledge. Some of them used SWOT[7]-analyses and audits in specific areas to regularly enhance organisational knowledge. One organization is using self-assessments in a recurrent (annual) process at company level to identify knowledge needs, existing knowledge and competences, as well as knowledge gaps to assess KM risks. Other organizations plan to do it and in one organisation no such self-assessments are carried out to enhance organizational knowledge.

Q17. Is a user manual made available?

Most organisations are in the process of providing such a user manual. One organisation has already a complete user manual. In other organisations such efforts are in progress and a user manual can be partly provided. However, in two organizations there is no specific user manual for their KMS available.

Q18. How often is the knowledge base on the system changed, i.e., new content added (= new knowledge input) or existing content updated?

The KMS of the surveyed organizations are updated mostly on a weekly basis, but the update intervals range from a daily up to a yearly basis and changes can also be done on an as-needed basis without any specific frequency.

Q19. Is the captured knowledge initially reviewed/approved after capture?

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[7] SWOT analysis is a strategic planning technique used to help a person or organization identify strengths, weaknesses, opportunities, and threats related to business competition or project planning.

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All surveyed organisations except one answered yes.

Q20. Is your KM system open and accessible from outside for knowledge retrieval?

In most surveyed organizations their KMS are only partly accessible for knowledge retrieval from outside the organization. Two organizations do not permit external access to their KMS at all.

Q21. Is your KM system open and accessible from outside for knowledge input?

Here, the KMS of the majority of surveyed organizations is not accessible from outside for knowledge input. However, there are two organizations where this is partly possible.

Q22. If yes in Q21, please state how do external users get access to the KM system for testing?

None of organizations shared with us information on how external users can access the KMS of their organizations. For publicly available information the system is accessible via the internet (web site of organization or directly accessible via an internet link) or via social networks. For information, which is not yet open to the public some organizations turn to target users or test groups to gather valuable feedback.

Q23. If yes in Q21, please state if and how the KM system can be tested by the EURAD WP11 team?

Two organizations would offer access to their KMS to demonstrate how it works, with access details and procedures still to be negotiated. The others are reluctant to make this offer.

Q24. What software / methodology is used to capture and disseminate information?

To capture and disseminate information the surveyed organizations use Content Management Software (CMS) such as:

* IBM Domino (https://www.ibm.com/support/pages/ibm-domino-ibm-i) based systems
* MS SharePoint (https://www.microsoft.com/de-de/microsoft-365/sharepoint/sharepoint-server)
* Kolibri (https://www.kolibri-software.de/portfolio/gebaudemanagement/)
* Mendeley (https://www.mendeley.com/download-desktop-new/),

Q25. Which kind/type of metadata is included?

Metadata varies depending on the information it carries, e.g. metadata to describe documents (author, title, date, keywords, project, publication date, ISSN, ISBM, DOI, etc.), descriptive metadata, administrative metadata, structural metadata. If not specified by regulators, stored metadata is based on relevant standards (for example: NDA standard IMP06) and company needs. As an example the metadata used in the EC JRC publication system, i.e. the publicly accessible part of the internal publication repository, can be found at https://publications.jrc.ec.europa.eu/repository/handle/JRC106253?mode=full.

Q26. What is the access rate to the KM System at your company/institution/organisation per month?

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There was only one group, which was able to specify their access rate (from internal users: 10000 - 12000, from external users: 2235 users (=persons accessing the system identified by their IP address), 10333 views (= how many times documents have been used) per month on average). The others were not able to provide such figures.

Q27. How actively is the KM system technically updated?

All questioned organizations technically update their KM system only when they consider this as necessary.

Q28. Are there plans to expand the KM system?

All organizations except one have plans to expand their KMS, with respect to complementary contents (regardless of where it is hosted) to provide recommendations to users or to increased usability of the KMS by internal users in their organizations. In addition, there are plans to further develop their databases to collect results of product conformity assessment, voluntary certification of products and quality management systems and in addition there are plans to strengthen information security.

Q29. In which way is a quality assurance (QA) for the KM system performed?

QA is performed by all surveyed organizations by pre-input screening and an associated review process. In addition, some of the questioned organizations check for their updating features, the updating of content and specifically perform a periodic quality check of the content's relevance and actuality.

Q30 Is the user feedback (internal and external) concerning operational experience (lessons learnt), used by the organization?

Only half of surveyed organizations is using the received feedback on operational experience to improve their system.

Q31. What kind of functionality is offered to end-users?

The usage of information from a knowledge management portal, e.g. the extraction editing and commenting is offered to end-users. One organisation also provides access to a GIS[8]-server for internal end-users through the KMS.

Q32. What kind of functionality is offered to editors/input experts?

In general, editors as input experts may enter information to databases, add documents to the knowledge portal, to the quality management centre module, to the website of the organization, edit it and assign tasks, but also provide input to expert websites such as maintained by UATOM, and social network pages. In addition, they process and respond to the users'

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[8] A geographic information system (GIS) is a framework for gathering, managing, and analyzing data.

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feedback through respective communities. They can share information too. One organisation also provides tool kits, matrix and checklist to editors / experts.

Q33. How does the company/institution/organisation advertise their KM systems in order to inform users about its capabilities?

The way the surveyed organizations advertise their KMS is different for each organisation. It is done, e.g. by internal communication (internal staff meetings), by their intranet (by emails), by weekly newsletters, through available user manuals and by regularly training events on KMS usage.

Q34. Is your KM system compulsory for your institution?

All interviewed organizations stated that their KMS is compulsory for their institution.

Q35. Which software components are used to build the KM System?

The majority of questioned organizations use proprietary software:

- Open text (Hummingbird, https://www.opentext.com),
- Lotus Domino (https://www.bsws.de/lotus-domino/, later owned by IBM and now HCL)
- MS SQL (https://docs.microsoft.com/en-us/sql/ssms/download-sql-server-management-studio-ssms?view=sql-server-ver15))
- MS SharePoint (https://www.microsoft.com/en-us/microsoft-365/sharepoint/collaboration)
- ArcGIS server (https://enterprise.arcgis.com/en/server)
- Lascom Project Life Management (PLM) (https://www.lascom.com/challenges/workflow-and-program-lifecycle-management/)
- Aleph Exlibris (https://knowledge.exlibrisgroup.com/Aleph)
- Alfresco

These software packages often required necessary adaptations combined with open source tools. Only one organization founded their KM system completely on an in-house development.

Q36. Does the organization utilize appropriate IT support systems and tools? Please mark them accordingly in the following table.

A more detailed description of IT techniques used in KM, e.g. the ones listed below, is provided by the IAEA-TECDOC-1675 and references therein.

Content/document management: Almost all asked organizations have document management in their organizations and answered yes. Only one organization answered no to this question.

Concept mapping: Concept mapping is used by one organization. Most of the surveyed organisations do not use it yet, but are planning to implement it in their organization. Two organisations do not intend to use it in future.

Knowledge databases: The majority of the surveyed organisations are using this tool. One organisation is using it only in some cases.

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Simulation tools: Nearly each surveyed organization stated that they use this tool in their organization. One organisation is using it only in some cases and one is not using it at all.

Enterprise resource planning: The majority of the questioned organisations use enterprise resource planning. Only two organizations do not use it at all.

Portals/Intranets: All of the questioned organisations use portals and intranet.

Knowledge search engines: The majority of the surveyed organisations are using this tool. One organisation is using it only in some cases and one is not using it at all.

Expert yellow pages: Two of surveyed organizations use this tool. Two organizations informed us that they are planning to use it.

Expert systems: This tool is used only by one organization and another organization plans to use it.

Wikis/blogs: One organisation just started to use it and another is planning to use it.

Others: There is no other tool used in surveyed organizations

Q37. Who provides the IT infrastructure for the KM system?

Most of organizations have established an internal IT infrastructure for their KMS. One organization is using an external service provider and another organization is using both, i.e. it has established an internal IT infrastructure for their KMS and in addition is using an external service provider to support this KMS.

Q38. Is the KM system web based?

Almost all surveyed organizations used web-based systems. Only a few organizations answered with partly web based or that the implementation of such a KMS is in progress.

Q39. To which standards (e.g. SQL, JSON, HTML etc.) is conformity implemented?

This was a very specific technical question and therefore only three organizations replied and stated that they use as a database "Notes Storage Facility – NSF" (IBM adaptation of the flat file database), ORACLE, SQL, and MS SQL, respectively. Frontends used are based on programs implemented in C, C++, Java or are directly using MS SharePoint, MS Access.

a) ORACLE (https://www.oracle.com/de/index.html) is combined with three different frontends: 1) Aleph, which has a proprietary client manager application for the libraries and a web query part of the catalogue that is based in HTML; 2) Documenta (https://www.documenta.de), which is a Java application based on JavaServer Pages (JSP) and HTML via the web; and 3) Alfresco, which has its own HTML-based app "Alfresco

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Share" and can also be accessed via Java & Common Management Information Services (CMIS).[9]

b) Generic SQL applications are usually coupled to frontend based on either ASP.NET, .NET, or C#.

Q40. What do you expect from a technical point of view from a EURAD KM System based on your own experiences of KM Systems? What are the lessons learnt?

It is expected by most of the surveyed organizations that the available information in the EURAD KMS should be well structured, well defined and kept updated by using a relational database. Other expectations concern its robustness, security, and multifunctional search capabilities. Furthermore, a user friendly interface with the ability to shape the Graphical User Interface (GUI) according to the user's requirements, user friendly processes for using it, EU General Data Protection Regulation (GDPR) and copyright compliance, ability to conduct user surveys (such as this one) are explicitly mentioned.

A EURAD KMS should provide a fit for purpose technical solution which addresses all phases of the KM lifecycle, including capture, creation, storage, processing, access, dispose within statutory and regulatory guidelines and will have clear definitions.

From a technical point of view, the participating organizations expected the system to be fast when downloading files (maybe a compressed file system should be integrated), i.e. it should be able to handle big volumes of data and therefore appropriate equipment should be used, which allows performing the tasks in a rather short timeframe. In addition, it should be accessible through the internet.

One organization recommends to design the KMS together with the users, including testing and improving the system. Moreover, it is recommended to pay specific attention to the promotion of the KM system and to provide sufficient training opportunities.

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[9] The Common Management Information Service (CMIS) is the service interface specified in ITU-T Recommendation X.710, ISO/IEC International Standard 9595 that is employed by OSI network elements for network management.

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4. Conclusions

The answers to the questionnaire gave insights for five different categories of prerequisites turning out to be most important for developing, planning, implementing and maintaining a large-scale, sustainable KM system. They can be formulated as questions:

(a) how to update content due to further progress in knowledge (identified by either the KMS custodian, the KMS user community or others),

(b) how to reach and attract a large user community,

(c) how to create a network for exchange to generate active usage and a lively environment with the possibility to find people willing and able to discuss certain issues, find links and share events for training opportunities,

(d) what can be copied / transferred from others KMS in order to find cost-efficient and convincing solutions for the EURAD KMS,

(e) how to achieve sustainable maintenance & development of KMS and support it's continuous improvement.

The most relevant recommendations extracted from the responses to the questionnaire are as follows:

1. Development of a portal-KMS with long-term maintenance perspective is recommended.

2. Major lesson learnt was that it is essential to provide continually site & content maintenance, updates, continuous improvement and popularity. For this reason, a knowledge IT manager appointment for a portal-KMS is strongly recommended, as well as content curators.

3. Interface and structure of portal-KMS should be user friendly, i.e. easy in technical operation, with a well-structured graphical user interface, clear responses to erroneous or ambiguous user entries, understandable documentation and manuals, and a variety of search functions, e.g. through a search engine or a system of categorization.

4. It is recommended to continue close cooperation with IAEA & OECD/NEA for revision of available information as well as service & products already provided in RWM KM in order to avoid efforts duplication. By doing this the EURAD KM tool will be more convincing in content and usability. This is essential to become a recognized authority in this field.

5. The surveyed organizations stated that clear definitions of terms used in RWM are required.

6. It became obvious that the majority of organizations already use IT tools. However, KM tools and respective techniques are so far not implemented in many organizations. To organise a series of training courses on KM aspects and fundamentals, tools, techniques and lesson learnt is considered helpful.

7. The received feedbacks indicated the need of technical tutorials and training courses on specific portal-KMS usage.

8. A creation of a Communities of Practice (CoP) or professional network of experts is considered essential. The objective of such a network is support and assistance in filling knowledge gaps and enlarging knowledge. Such a network could further help with its experience in KM implementation.

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9. The EURAD portal-KMS should be linked to international organisations, internal regulatory bodies, conferences, information of upcoming events, latest publications, news, announcements, etc. All such linkages should be updated by a responsible content curator of the portal-KMS.

The above list (based on the questionnaire responses) allows the derivation of direct recommendations with respect to features and capabilities that are essential for the upcoming EURAD KMS. Here, the list of useful WWW references to already existing KMS packages and codes (or components thereof) extracted from the questionnaire responses (Annex A) will be a substantial support. The following set, referred to as specification report before, relates these features and capabilities to the above list (*cf* numbers in parentheses). Reminder: the order does not imply any ranking.

- Clear definition and distinction between the management functions of content curators and KMS IT maintainers (1, 2)
- Provision of an exhaustive (online) manual, addressing both needs of users, content curators and KMS IT maintainers (1, 6, 7)
- Mirroring and backup tools to avoid data loss and access interruptions (1)
- Easily track user activity including content publishers (2)
- Statistical data collection (view, saving, changing, most used topics, often updated documents, countries), analysis and automated report generation (1, 2)
- Established personal data protection (1, 2, 8)
- Well defined & easy to control tiered access granting (reading / writing / releasing / maintaining) including registration and password protection where appropriate (1, 2, 3)
- Any updated version of documents need internal check by curator(s) before making them accessible to the public (2, 3)
- Sophisticated search functions (3)
- Full tracking of document changes to allow restoring of earlier versions if needed (3)
- Possibility to tag content guided by a standardized vocabulary including a glossary and thesaurus (3, 5)
- Possibility to link content. If legally permitted, content from external providers should be mirrored on dedicated servers. This will also reduce the risk of loss of external sources and "dead links" that will otherwise accumulate over time (3)
- Clear hierarchy of knowledge following the GBS (3, 5)
- Alerting mechanisms to display new published content automatically to users that indicate specific interests (3)
- References to names, area of expertise and relevant publications with respect to the authors of each document (3, 8)
- Establishment of 'Communities' to enable users to create their own teams in different topics, to share their documents, data, information and knowledge (4, 8)

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- E-workspace linked to such communities for online exchange of information, experience and insights on RWM issues (4, 8)
- Link to (external) E-learning modules provided by EURAD WP13 (4, 6, 7, 8, 9)
- Links to other international organizations (IAEA, NEA/OECD, WNA, ENEN, …) and national RWM stakeholders, as well as other RWM portals and resources (9)

And last but not least, the questionnaire revealed several expectations from the organisations explicitly placed on the upcoming EURAD KMS:

- All surveyed organizations consider KMS essential for their organization and are expecting continual assistance and support in KM from EURAD.
- Development & sustained maintenance of the KMS is expected from EURAD.
- Interviewed organizations expect to have unlimited access to portal-KMS.

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Annex A: References to KMS packages and tools

1. https://www.documenta.de/

2. https://www.oracle.com/de/index.html

3. https://www.opentext.com

4. https://www.bsws.de/lotus-domino/

5. https://docs.microsoft.com/en-us/sql/ssms/download-sql-server-management-studio-ssms?view=sql-server-ver15

6. https://www.microsoft.com/en-us/microsoft-365/sharepoint/

7. https://enterprise.arcgis.com/en/server

8. https://www.lascom.com/challenges/workflow-and-program-lifecycle-management/

9. https://knowledge.exlibrisgroup.com/Aleph

10. https://www.ibm.com/support/pages/ibm-domino-ibm-i

11. https://www.kolibri-software.de/portfolio/gebaudemanagement/

12. https://www.mendeley.com/download-desktop-new/

13. https://moodle.org/

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Annex B1: Questionnaire Part I (without preamble)

1. **Please state your name and your company/institution/organisation:**

   _____

2. **What are the minimum requirements of a EURAD KM from your perspective with respect to organisation and policy to share and develop knowledge? Your answer should (a) provide a clear definition of components and system, (b) address the interfaces between the components and (c) describes the roles and possibilities of contributing actors and how they could benefit.**

   (a) _____

   (b) _____

   (c) _____

3. **What structural types of information should the EURAD KM system contain at the first stage, i.e. within the first two years?**

   o Scientific Papers
   o Reports
   o Presentations
   o Announcements (courses/classes)
   o Schedule (courses/classes)
   o Workshops (announcements/learning materials)

4. **Do you think that it is necessary to have the architecture of the KM system in a matured form before populating it with content?**

   o Yes
   o No
   o Not sure
   o Comments: _____

5. **For the digital KM tool: which input formats of the documents would you prefer?**

   o PDF
   o MS Word
   o ODT
   o LaTex
   o HTML
   o XML
   o Other, please specify:_____

6. **For the digital KM tool: which output formats of the documents would you prefer?**

   o PDF
   o MS Word
   o ODT
   o LaTex
   o HTML
   o XML
   o Other, please specify:_____

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7. **Which language specifics of documents in the EURAD KM-System (in addition to the mandatory English documents / translations) do you also consider useful?**

    o   Original document provided in the native language
    o   No other versions

8. **Are you interested in an interactive communication like chat rooms or forums?**

    o   Yes
    o   No

9. **Would you be interested in collecting and processing statistics of the KM usage, e.g. to identify "hot topics"? If yes, please mark the respective items:**

    o   User access [10](kind of user, user identity, country, institution etc.)
    o   Most frequently accessed documents
    o   Most often downloaded documents
    o   Topics looked at
    o   _____

The following questions can be answered if you have an existing KM system or if you have had experiences (setting up, keep it running,) with a KM system in the past:

10. **Do/did you extract information from a KM system?**

    o   Yes
    o   No

11. **If yes to Q10: How often on average and what kind of information do/did you extract as a user from a KM system? (max. 50 words)**

    o   Frequently
    o   1-2 times a week
    o   1-2 times a month
    o   1-4 times a year

    Information type: _____

12. **Do/did you feed information into a KM system?**

    o   Yes
    o   No

13. **If yes to Q12: What are the sources of the information that you submit?**

    o   Own knowledge
    o   Knowledge identified from external sources
    o   No

14. **Do you know organisations/institution/companies - inside or outside of the Nuclear/Radioactive Waste Sector - which might have/using a well working KM system? If yes, please name them.**

    _____

---

[10] Typically only those users that at least clicked on an embedded link or downloaded a document

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15. **From your experience with existing KM systems: What are the lessons learnt? Namely, which drawbacks would you like to see avoided and which good points to be copied by the EURAD KM?**

    o   Lessons learnt: _____
    o   Drawbacks: _____
    o   Strengths: _____

16. **What is the expected benefit from the EURAD KM system for your national RWM programme?? (max. 10 keywords)**

    _____

17. **Are you willing to participate as an expert/member of a scientific board for the pre-selection of the input documents?**

    o   Yes
    o   No
    o   No, but I can provide a useful contact

        If so, please specify: _____

18. **If yes to Q17, please state to which time extent (per week):**

    o   1-2 hrs
    o   3-5 hrs
    o   > 5hrs

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Annex B2: Questionnaire Part II (without preamble)

Please answer this section only if you have already gained experience with KM-Systems

1.   **Please state your name and your company/institution/organisation:**

   _____

2.   **Do you already have an existing KM system at your company/institution/organisation?**

   o   Yes
   o   Partly / in progress
   o   Planned
   o   No

   Comments: _____

3.   **If yes to Q2: How many years ago was the KM system established?**

   o   < 5 years
   o   5-10 years
   o   > 10 years

4.   **If yes to Q2: For what time span of active usage is/was this KM system planned?**

   o   5 -10 years
   o   10-20 years
   o   20 years
   o   unlimited (perspective for a long time)

5.   **How is your KM system organized?**

   o   Centralized
   o   Decentralized
   o   Distributed

   Comments: _____

6.   **Does your KM system have a central curator who organizes updates and manages its content?**

   o   Yes
   o   Partly / in progress
   o   Planned
   o   No

   Comments: _____

7.   **Does your company/institution/organisation have a written policy for implementing its strategy in the KM area?**

   o   Yes
   o   Partly / in progress
   o   Planned
   o   No

   Comments: _____

8.   **If yes to Q7: Is KM policy of your organisation integrated into quality management system?**

   o   Yes
   o   Partly / in progress
   o   Planned
   o   No

   Comments: _____

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9. **Does the strategy of your organization supports continuous learning to improve individual and organizational performance?**

    o   Yes
    o   Partly / in progress
    o   Planned
    o   No
    o   Comments: _____

10. **Is the KM system tool in your organisation based on a KM policy?**

    o   Yes
    o   Partly / in progress
    o   Planned
    o   No
    o   Comments: _____

11. **Do you have experiences with KM systems which were abandoned?**

    o   Yes
    o   No

12. **If yes to Q10: Can you name the reasons why the KM-System was abandoned? (max. 50 words)**

    _____

13. **Does your organisation utilise methods to identify people who have critical knowledge[11]?**

    o   Yes
    o   No

---

[11]**Critical knowledge** means knowledge established in the context of a particular position that is deemed imperative for incumbents of said position to possess before being allowed to perform associated duties and tasks independently. (IAEA definition)

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14. Does your organisation adopt certain techniques to capture critical knowledge such as:

	Yes	Just started	Not yet, but planned	In some cases	Not
Elicitation interviews					
Video capture					
On the job training dialogue					
Mentoring/Coaching					
Communities of Practice					
Explicit capture (narrative documentation)					
Card sorting (manual concept map)					
Concept mapping					
Experience feedback					
Systematic synthesis					
Decision tracking					
Audio or video recording of 'storytelling'					
Knowledge audit method;					
Case study simulation and walkthrough					
Task diagram					
Annotation of existing documents, calculations, procedures					
System engineering notebooks					
Database capture					
Others:_____					

15. Does your organisation have a comprehensive methodology that addresses learning from experience?

- o   Yes
- o   Partly / in progress
- o   Planned
- o   No

Comments: _____

16. Are self-assessments regularly used to enhance organisational knowledge?

- o   Yes
- o   Partly / in progress
- o   Planned
- o   No

If not "No", please specify the type of self-assessment

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_____

17. Is a user manual made available?

- o Yes
- o Partly / in progress
- o Planned
- o No

Comments: _____

18. How often is the knowledge base on the system changed, i.e., new content added (= new knowledge input) or existing content updated?

- o Weekly
- o Monthly
- o Yearly
- o Not known
- o Others – please specify: _____

19. Is the captured knowledge initially reviewed/approved after capture?

- o Yes
- o Partly / in progress
- o Planned
- o No

Comments: _____

20. Is your KM system open and accessible from outside for knowledge retrieval?

- o Yes
- o Partly / in progress
- o Planned
- o No
- o If not "No", please specify who can access your KM system_____

Comments: _____

21. Is your KM system open and accessible from outside for knowledge input?

- o Yes
- o Partly / in progress
- o Planned
- o No
- o If not "No", please specify who can access your KM system_____

Comments: _____

22. If Yes to Q20, please state how do external users get access to the KM system for testing (max. 50 words)?

- o How to get formal permissions: _____
- o How to access the KM system technically: _____

Comments: _____

23. If Yes to Q20, please state if and how the KM system can be tested by the EURAD WP11 team?

- o Yes

    If Yes, how: _____

- o No

24. What software / methodology is used to capture and disseminate information? (max. 50 words)

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_____

25. Which kind/type of Metadata is included? (max. 50 words)

_____

26. What is the access rate to the KM-System at your company/institution/organisation per month?

- o   From internal users   _____
- o   From external users   _____
- o   No statistics available

27. How actively is the KM system technically updated?

- o   Only when necessary
- o   Every year
- o   Others: _____

28. Are there plans to expand the KM system?

- o   Yes
- o   No

> If yes, please specify in which direction (content, subjects, usability, inter-operationality, GUI) your KM system shall be expanded (max. 50 words): _____

29. In which way is a quality assurance (QA) for the KM system performed?

- o   pre-input screening & review process
- o   issues of updating features
- o   issues of updating the content
- o   logging
- o   periodic quality check of content relevance / actuality
- o   Others: _____

30. Is the user feedback (internal and external) concerning operational experience (lessons learnt), used by the organization?

- o   Yes
- o   No

> If yes, please specify for what it is used. _____

31. What kind of functionality is offered to end-users? (max. 50 words)

_____

32. What kind of functionality is offered to editors / input experts? (max. 50 words)

_____

33. How does the company/institution/organisation advertise their KM systems in order to inform users about its capabilities? (max. 50 words)

_____

34. Is your KM system compulsory for your institution?

- o   Yes
- o   No
- o   Planned
- o   Partly planned

Comments: _____

35. Which software components are used to build the KM-System? (max. 50 words)

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- o Proprietary (Name and vendor): _____

  Where there adaptations necessary:
  - o Yes
  - o No
- o In-house development
- o Open source (Name): _____

  Where there adaptations necessary:
  - o Yes
  - o No

36. Does the organization utilize some of the below listed IT support systems and tools? Please mark them accordingly in the following table.

	Yes	Just started	Not yet, but planned	In some cases	No
Content/document management					
Concept mapping					
Knowledge databases					
Simulation tools					
Enterprise resource planning					
Portals/Intranets					
Knowledge search engines					
Expert yellow pages					
Expert systems					
Wikis/blogs					
Others (Please specify)?					

37. Who provides the IT infrastructure for the KM system?

- o Your institution
- o External service provider

38. Is the KM system web-based?

- o Yes
- o Partly / in progress
- o Planned
- o No

39. To which standards (e.g. SQL, JSON, HTML etc.) is conformity implemented?

Database: _____

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40. What do you expect from a technical point of view from a EURAD KM-System based on your own experiences of KM-Systems? What are the lessons learnt? (max. 150 words)

_____

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