

European partnership on radioactive waste management

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Abstract. The European Commission supports a co-funded European Partnership on radioactive waste management within the EURATOM Work Programme for 2023-2025. This initiative, known as EURAD-2, aims to continue and merge the efforts of the EURAD Programme and the PREDIS project, building on their successes and lessons learned. EURAD-2 addresses the European Union's 3.5 million m³ radioactive waste inventory with a holistic approach, targeting the whole waste management chain from cradle to grave, up until its final disposal in surface, shallow, and deep geological facilities. As a co-funded Partnership, it supports Member States in meeting the Research, Development and Demonstration requirements of the Waste Directive 2011/70. The programme includes diverse participation, with 51 beneficiary organisations and 69 Affiliated Entities from 21 Member States, funded at 60% by the European Commission and 40% by the participating Member States. Furthermore, it welcomes participation from associated countries and interacts proactively with international organisations such as NEA and IAEA.

The EURAD-2 work plan addresses strategic aspects identified in the updated EURAD Strategic Research and Knowledge Management Agenda. To this end, the Partnership employs different instruments (different types of work packages): research and development – performing cutting-edge science and technology research and innovation; Strategic Studies – shorter-term transversal collaborative actions bringing together relevant actors and addressing emerging needs; Knowledge Management – supporting the transfer of knowledge between different programmes and between generations.

EURAD-2 aspires to contribute as one of the leading European platforms for radioactive waste management competence, know-how, and capabilities, supporting scientific excellence and driving innovation in research and technology for its end users. It aims to be a central hub for training new experts and facilitating high-visibility position papers on emerging topics, further establishing the European Union as the forerunner in safe, long-term radioactive waste management.

1 Introduction

The European Commission has launched, within the EURATOM Work Programme for 2023-2025, a Grant to Beneficiaries for a co-funded European Partnership on radioactive waste management. This partnership aims for the continuation and merge of the EURAD Programme¹ and PREDIS project².

Similar to the previous programme, EURAD-2 supports the implementation of the Waste Directive 2011/70 in EU Member States, considering and bringing together the various stages of advancement of national programmes, the differences in capabilities and inventories.

The main goals are to [1]:

- Support Member States in developing and implementing their national research demonstration and development (RD&D) programmes, as reported to DG ENER for the safe long-term management of their full range of different types of radioactive waste through participation in the radioactive waste management (RWM) Joint Programme;
- Develop and consolidate existing knowledge for the safe start and operation of the first geological disposal facilities for spent fuel, high-level waste, and other long-lived radioactive waste, and supporting optimization linked with the stepwise implementation of geological disposal facilities;
- Building on the achievements of EURAD and PREDIS, maintain a knowledge management programme that enhances the transfer of knowledge between organisations, Member States and generations.

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¹ <https://www.ejp-eurad.eu/>

² <https://predis-h2020.eu/>

2 Leveraging past projects and established methodologies

EURAD-2 is built on the lessons learned and the success of both EURAD and PREDIS projects. Hence the founding documents such as the Vision [1], the updated Strategic Research & Knowledge Management Agenda [2] and the Roadmap [3] remain the founding documents of this new Partnership.

2.1 Founding documents

Convinced that after five years of implementation, the EURAD Vision is still lively and valid. EURAD-2 builds upon EURAD and PREDIS to further implement a joint strategic programme of research & development, strategic studies and knowledge management activities at the European level, bringing together and complementing EU Member States' programmes in order to ensure cutting-edge knowledge creation and preservation in view of delivering safe, responsible and publicly acceptable solutions for the management of radioactive waste throughout all programme phases across Europe now and in the future. Responsible means following the waste hierarchy requiring that waste is managed without endangering human health and harming the environment; without risk to water, air, soil, plants or animals; according to the "polluter pays principles".

2.1.1 Roadmap

The intended purpose of the EURAD Roadmap is to provide a high-level structure of generic and typical radioactive waste management programme activities and signposts to existing knowledge, based on learning from advanced programmes and people who have done it before [3]. It should not be considered as all-encompassing yet captures the highest priorities of the participants. Because of its generic nature, the EURAD Roadmap is populated with content that is common to all programmes, providing greater resolution to technical aspects of implementing improved predisposal practices and deep geological repositories for final disposal. National programme-specific activities, such as overall predisposal management and strategies for stakeholder and community interactions, are recognised as critical and significant but are covered in less detail compared with DGR technical activities due to their maturity. The update of the Roadmap is considered on an as-needed basis. However, technical aspects of the need for interaction between predisposal activities and the road to a DGR are covered.

2.1.2 Strategic Research Agenda

The EURAD Strategic Research Agenda (SRA) is based on the EURAD Roadmap representing a generic radioactive waste management programme and identifies activities of joint interest between European Waste Management Organisations (WMOs), Technical Safety Organisations (TSOs) and Research Entities (Res), where there

is added value at the European level, compared with conducting activities at the national level [2]. The SRA is a standalone document informing the community at large on issues and gaps, following a holistic approach to integrated management of radioactive waste "from cradle to grave" (excluding dismantling and decommissioning of nuclear facilities). The EURAD SRA has been updated under the auspices of EURAD (2019–2024) and considering the input from the PREDIS project and has been developed purposely to present a holistic, integrated view on identified needs of common interest that may require research, development and demonstration (RD&D), strategic studies (think tank), and/or knowledge management (KM) activities.

To make the SRA more useful for the definition of work packages constituting EURAD-2, all identified needs were characterized using a common set of drivers. This helps to make the SRA more focused on the 'what' can be done and 'why' [2]. The update has been developed with a 10-year forward horizon, building upon and complementing the extensive knowledge base that exists in radioactive waste management which has been developed over the past decades by the national programmes and international projects such as those (co)funded by the European Commission.

2.2 Objectives

2.2.1 Develop, maintain and consolidate the scientific and technical basis of radioactive waste management

The research, development and demonstration carried out in support of safe radioactive waste management, including disposal, is considered a key requirement of each national programme [1]. Given the long timescales and socio-political dimension, RD&D provides primarily the scientific basis for implementing safe and robust RWM solutions, whilst also contributing to building stakeholder trust, public acceptance, and training and education for the next generations of the workforce. With the first geological repositories coming into operation, scientific and technical activities are also shifting towards "optimisation" of the implemented solutions. EURAD-2 implements in a collaborative way those aspects of RD&D activities where synergy from Programming at the European level has been identified.

EURAD-2 continues to collaboratively develop, maintain and consolidate at the European level the scientific and technical basis of RWM, including disposal. The scope of EURAD-2 includes scientific and technical activities on all steps of RWM:

- Radioactive waste inventory including steps to minimize final radioactive waste to be managed;
- Radioactive waste characterisation & processing (including pre-treatment, treatment and conditioning);
- Interim storage of radioactive waste; and
- Disposal solutions – with the main focus on geological disposal of spent fuel, high-level waste (HLW)

and long-lived intermediate-level waste (ILW). However, specific RD&D required for near-surface or surface disposal of low-level waste (LLW) is addressed as well.

Nuclear facility dismantling and decommissioning activities are however excluded, although some specific interfaces, and particularly aspects that impact final disposal, are considered.

2.2.2 Address important & complex issues and enable expert networking

Complementary to RD&D and in support to the implementation of the Member States' national programmes, EURAD-2 allow participants and expert contributors to network on methodological and strategic issues and challenges that are common to various national programmes and indirect links with scientific and technical issues:

- Share knowledge and discuss upcoming methodological/strategical challenging issues that are in close link with scientific, technical and societal aspects on RWM and that are common to various national programmes;
- Identify the contribution of past/ongoing RD&D projects to the resolution of these issues;
- Identify any emerging topics for collaboration that could be addressed within a European Programme;
- Take into account emerging science and technology as well as research priorities originating from other programmes (e.g. results from Horizon Europe projects, H2020 projects or IAEA outputs).

Compared to the previous EURAD programme, more strategic studies have now been embedded within EURAD-2 and most of them are limited to a maximum duration of 24 months, thereby influencing a possible next wave of RD&D work packages near the midpoint of the partnership if there is allocated Euratom budget.

2.2.3 Enhance knowledge management and transfer between organisations, Member States and generations

It is essential to implement an efficient and integrated Knowledge Management programme at the EU level in order to establish, capitalize and transfer the state of scientific and technical knowledge, competencies and capabilities in the field of RWM. The knowledge management and knowledge transfer activities follow the structure and context provided by the Roadmap to map and signpost the existing knowledge (Knowledge Capture), to develop guidance documents, and to provide training and allow for mobility across disciplines and organisations. The objective of EURAD-2 is to build further on the achievements and accomplishments of EURAD and PREDIS in expanding and complementing KM activities. Specific attention will be given to data management of the different work packages to safeguard these for future use. Additional efforts will be devoted to disseminating EURAD-2 results and adding value to a wider audience.

Moreover, the EURAD-2 programme also actively contributes to transferring knowledge across generations of

experts by allowing a sizable population of young scientists (PhDs, post-docs and MSc students) and next-generation experts to be trained within the programme.

2.2.4 Engage with Civil Society

The successful implementation of RWM national programmes relies on both scientific and technical aspects for a sound safety strategy and scientific and engineering excellence and societal (social, legal, ethical, political) aspects [1]. Interacting with Civil Society is important in this perspective and therefore one further highlighted objective of EURAD-2, as in EURAD, is to allow interactions between WMOs, TSOs, REs and Civil Society Organisations (CSO). These interactions will facilitate the translation of scientific/technical results and create the conditions for CSOs to express their expectations and views. Such interactions shall improve the mutual understanding of RD&D performed to support the development of safe solutions for the processing and disposal of radioactive waste. EURAD-2 shall also contribute to developing ideas, propositions and methodologies on how to interact with Civil Society on scientific and technical results uncertainties (inherently linked to the long timeframes and numerous processes considered for geological disposal), and on how to interact with Civil Society stakeholders in order to promote mutual benefit of the available knowledge, based on cooperation and sharing.

3 Pathway towards impact

EURAD-2 addresses the 3,500,000 m³ inventory of radioactive waste across European Union Member States, with a holistic approach covering all materials from very-low-level and low-level waste (>90%) through high-level waste (0.2% in volume) [4]. The programme strives to have impacts that cover surface-, shallow- and deep geological disposal facilities, as well as pre-disposal and interim storage practices, to provide Member States with better technologies and tools to demonstrate advancing waste management practices. This also includes aspects of sustainability, through the use of better materials having a lower environmental footprint and supporting the waste hierarchy of avoiding and reducing radioactive waste streams.

As a co-funded European partnership, the programme must aim to assist Member States in reaching their RD&D requirements as implied by the Waste Directive 2011/70, while offering optimal value for money and by creating measurable impact. 21 Member States have given mandates to 51 organisations (22 as RE, 15 as TSO and 14 as WMO) to represent their countries in making impacts through the RD&D and KM programme of EURAD-2. 69 organisations also participate as Affiliated Entities. In total, 40% of the funding to implement EURAD-2 is coming from Member States' representatives and end users who have a need for the project, and have prioritized their needs through the College activities to develop the implementation Work Packages.

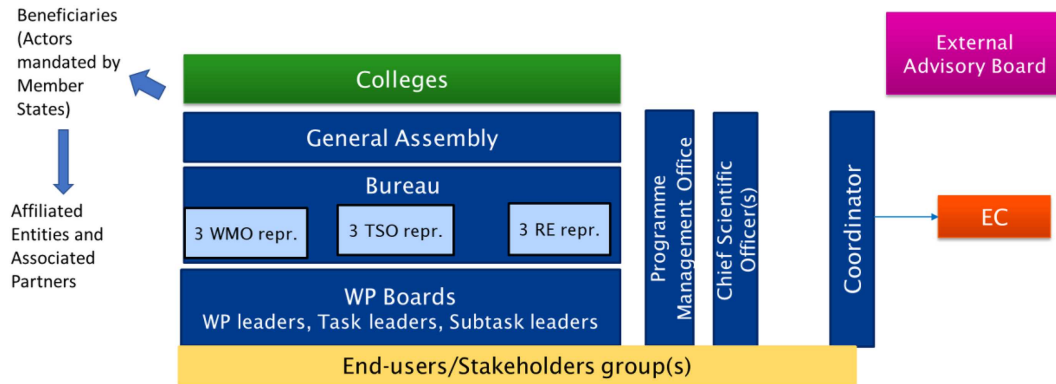


Fig. 1. EURAD-2 Governance structure.

3.1 Governance

One of the successes of EURAD was the involvement and collaboration between the three Colleges:

- The implementer function is represented by Waste Management Organisations (WMOs) through the IGD-TP³, whose mission covers the management and disposal of radioactive waste, the development of Safety Cases, planning, construction, operating and optimizing DGRs.
- The regulatory function is represented by Technical Safety Organisations (TSOs) and other organisations fulfilling an “expertise function” through the SITEX.Network⁴, carrying out activities aimed at providing the technical and scientific basis for notably supporting the decisions made by a national regulatory body,
- Research Entities (REs) performing independent high-quality RD&D in RWM are represented by EURAD-Science.

The representativity and impact of the programme are directly dependent on the involvement of those three Colleges in the overall process. Therefore, all participants are required to be linked to one of the three Colleges to participate in the programme. The governance of the programme remains the same as in EURAD with the Mandated Actors, all represented in the General Assembly and the Bureau nominating Colleges’ members to act on behalf of the General Assembly in close cooperation with the Programme Management Office (PMO) (Fig. 1).

The Bureau refers to selected representatives of Colleges who operate as the accompanying body to the General Assembly. It assists the GA in any update of the founding documents, are definition of the second wave of R&D WPs and must seek a consensus among the Parties.

The Programme Management Office is in charge of the scientific and technical coordination of the programme, as well as day-to-day management and communication activities. The members are selected by the Coordinator who

will seek the support of a panel as appropriate. It is foreseen that the representativeness of Colleges will be ensured in the PMO.

The Chief Scientific Officer(s) is (are) in charge of enforcing internally the scientific leadership of the programme on aspects of science, technology and KM. He/she is not a member of the Consortium and has no direct link with the European Commission.

The External Advisory Board provides external expertise and a balanced perspective. Its members act as ambassadors of EURAD-2 and are not involved in the internal operations and/or feedback on the programme operations.

3.2 Participants

3.2.1 Consortium

EURAD-2 participants are organisations with scientific and technical responsibilities in the implementation of the national RWM programme and with a national mandate for their participation in the Consortium that are willing to pool resources in order to improve critical mass, efficiency and effectiveness in implementing solutions across Europe.

51 organisations from 21 countries have received a mandate from their National Programme owner to participate as “Mandated Actors” in EURAD-2 and 69 organisations are participating as Affiliated Entities. With 21 European countries participating in the Consortium, EURAD-2 will largely contribute to building a consensual view on those topics covered within the programme/based on the EURAD vision. Another pre-requisite to be part of the Consortium is also to be able and willing to provide the necessary co-funding to the programme. The co-funding prerequisite assures the added value the EURAD-2 programme brings at the EU level, complementing efforts already ongoing at the national level.

Recognising the need for fostering a more inclusive programme, EURAD-2 seeks to encourage broader participation by addressing Associated Partners, both from the European Union and outside. Therefore, 22 Associated Partners are actively participating in the Consortium in 17 work packages. Some of them (from within Europe) have been granted leadership roles based on their past

³ <https://igdtp.eu/>

⁴ <https://www.sitex.network/>

contributions and sustainable cooperation. The Consortium is also complemented by cooperative work from 5 national laboratories of the USA funded by the Department of Energy (DOE) Nuclear Energy division within 9 of the technical WPs, bringing significant added value.

Notwithstanding their category (Beneficiaries, Affiliated Entities or Associated Partners), all partners in a WP contribute to the results. They have been selected on the high added value they bring to make significant progress to address the targeted achievements but also on their expertise in a complementary way and the need to ensure inclusiveness and transfer of knowledge from more advanced programmes to early-stage programmes.

To drive a lasting change, EURAD-2 is also focused on capacity building within organisations. Therefore, the pairs for competence development (junior/senior), within institutes but also across institutes or countries were strongly encouraged to enhance awareness-rising, training and skill development as well as the need to have a strong PhD programme. Most of the work packages are constituted of a core group of key participants (5–10) who are doing the majority of the work, then a group of participants who are good contributors and some additional participants with minor roles to bring the diversity representation or to answer to competence development. This way EURAD-2 is open to all participants, and answers to the need for competence transfer without jeopardizing the achievement and excellence of the technical scope of the work packages.

3.2.2 Stakeholders' engagement

The programme will establish a group of end users who are outside of the programme participant organisations, to drive the research and innovation, based on diverse needs and challenges. The End Users Group (EUG) consists of European nuclear power plant operators and research reactor owners as radioactive waste producers, waste management organisations (WMOs) and regulators other than participants in a work package. The starting basis is the 25 EUG members from the PREDIS project as well as over 20 WMOs who have actively participated in EURAD.

The role of End Users is to provide external guidance and direction on the activities of the project. They are encouraged to:

- Provide information useful to the project regarding waste acceptance criteria, repository generic designs and requirements, waste volumes, challenges, pathways for demonstrations, and priorities for RD&D
- Participate in annual workshops and give feedback on project progress;
- Asked to review key draft documents as outcomes from the project;
- Donate materials, data, case studies and/or host demonstrations for up-scaling of new technologies or innovations developed in the scope of the project.

A stakeholder group will also be established to allow the wider community of potentially interested parties to be invited to public events. This stakeholder group is the main target audience for dissemination activities. It

can include end users in addition to other bodies, for instance, Research Entities (REs) and Technical Safety Organisations (TSOs), others than participants in a work package, companies providing services such as waste processing solutions, supply chain companies, municipalities, educators, civil society, etc. Public associations such as IAEA and OECD-NEA would be included in the Stakeholders group. The end users and stakeholders have no voting role and no budgetary allocations from the programme.

3.2.3 Involvement of regulators and waste generators

To improve upon the previous programme, EURAD-2 is reaching out to regulators and waste generators. Both groups are encouraged to be active as end-users or stakeholders to follow the project plans and outcomes. The engagement of waste generators will be done via the Sustainable Nuclear Energy Technology Platform (SNETP)⁵. For waste generators which are not a member of SNETP, they will have the option to be members of the end-users group organised by the Programme Management Office (PMO).

The engagement of regulators will be done via SITEX.Network and through discussion with the European Nuclear Safety Regulators Group (ENSREG) and OECD-NEA Regulators Forum. For regulators who are not a member of SITEX.Network or ENSREG, they will have the option to be members of the end-users group organised by the PMO.

It is recognised that regulatory authorities having an expertise function (in countries where no separate TSO exists) can be mandated by the National Programme Owner as TSO or become an Affiliated Entity to a TSO. Their cooperative participation must be under the same conditions as for all other partner organisations from all three Colleges. The maintenance of independence would remain an issue of the regulatory authority itself.

3.3 Workplan

The updated EURAD SRA 2023, which puts forward key strategic aspects that were prioritised by the national and international actors and stakeholders involved in its update, constitutes the basis for the definition of EURAD-2 work packages (Fig. 2). The broad activities mentioned below reflect those strategic aspects that are considered challenging or that present major opportunities that can be realised in the next ten years.

Integrated waste management to optimise waste/material handling practices and reduce costs across the full waste lifecycle remains a critical enabler for successful programme management regardless of its stage of implementation. Emphasis continues on the application of the waste hierarchy alongside improvements and deepening of application of sustainability goals in strategic waste management decision-making, including application of circular economy principles. The

⁵ <https://snetp.eu/>

WP number	WP name	EURAD Mandated Actor		
		WMO	TSO	RE
Programme Management Office				
1	Programme Management Office (PMO)	◆◆	◆	◆
Knowledge Management				
2	Knowledge Management (KM)	◆◆◆◆	◆◆◆◆◆	◆◆◆◆◆
Collaborative RD&D				
5	Innovative characterisation techniques for large volumes (ICARUS)	◆◆◆◆	◆◆◆◆◆ ◆◆	◆◆◆◆◆ ◆◆◆
6	Sustainable treatment and immobilisation of challenging waste (STREAM)	◆◆	◆◆	◆◆◆◆◆ ◆◆◆◆◆
7	Long-term performance of waste matrices (L'OPERA)	◆◆◆◆	◆◆◆◆◆	◆◆◆◆◆ ◆◆◆◆◆
8	Release of safety relevant radionuclides from spent nuclear fuel under deep disposal conditions (SAREC)	◆◆	◆◆◆◆	◆◆◆◆◆ ◆◆◆◆◆
9	Innovative and new container/canister materials under disposal fields conditions: manufacturing feasibility and improved durability (InCoMand)	◆◆◆◆◆	◆◆◆◆	◆◆◆◆◆
10	Hydraulic mechanical chemical evolution of bentonite for barriers optimisation (ANCHORS)	◆◆◆◆◆ ◆◆	◆◆◆◆◆	◆◆◆◆◆
12	Radionuclide mobility under perturbed conditions (RAMPEC)	◆◆◆◆	◆◆◆◆◆	◆◆◆◆◆ ◆◆◆◆◆
14	Near-surface disposal optimisation based on knowledge and understanding (SUDOKU)	◆◆◆◆	◆◆◆◆◆ ◆◆	◆◆◆◆◆ ◆◆◆◆◆
16	High fidelity numerical simulations of strongly coupled processes for repository systems and design optimisation with physical models and machine learning (HERMES)	◆◆◆◆◆ ◆◆	◆◆◆◆	◆◆◆◆◆ ◆◆◆◆◆
17	Criticality Safety for Final Disposal (CSFD)	◆◆◆◆◆ ◆◆◆◆◆	◆◆◆◆◆	◆◆
Strategic Studies				
3	Alternatives RWM strategies (ASTRA)	◆◆◆◆◆ ◆◆	◆◆◆◆◆ ◆◆	◆◆◆◆◆ ◆◆
4	WM for SMRs and future fuels (FORSAFF)	◆	◆◆◆◆◆ ◆◆◆◆◆	◆◆◆◆◆ ◆◆◆◆◆
11	Impact of climate change on nuclear waste management (CLIMATE)	◆◆◆◆	◆◆◆◆◆ ◆◆	◆◆◆◆◆ ◆◆◆◆◆
13	HLW repository optimisation including closure (OPTI)	◆◆◆◆◆ ◆◆◆◆◆	◆◆◆◆◆ ◆◆	◆◆◆◆◆
15	Next generation Digital Twins to support Optimisation, Construction and Operation of surface and subsurface radioactive waste management facilities (DITOCO2030)	◆◆◆◆◆	◆◆◆◆◆	◆◆◆◆◆ ◆◆◆◆◆
18	Development and Improvement of Quality Assured Thermodynamic Understanding for use in Nuclear Waste Disposal Safety Case (DITUSC)	◆◆	◆	◆◆◆◆◆

- ◆ WP Leader
- ◆ WP Leader as Affiliated Entity
- ◆ WP Leader as Associated Partner

Fig. 2. Detailed overview of EURAD-2 work packages.

new wave of small modular reactors that has surfaced in the past few years, provides unique opportunities and challenges to apply such integrated waste management “by design” (WP4 – FORSAFF). The plans in Europe are that the first SMR facilities would be in operation in the next decade (2030–2040) and 4th Generation reactors a decade later. This sets a need to holistically investigate the aspects for SMR and new types of reactor waste

management, from predisposal through disposal and for both LILW and HLW.

RD&D for predisposal is primarily on items that will lead to a major technology change and/or step changes in technical readiness level (WP6 – STREAM). Several areas are put forward including continuing to improve understanding of problematic wastes and novel solutions for small inventories (WP3 – ASTRA), particularly

mobile treatment facilities and new approaches for waste characterisation (WP5 – ICARUS), treatment and processing and including options for handling mixed wastes and implementing more environmentally friendly materials (WP6 – STREAM, WP7 L’OPERA).

An emerging need that spans across all RWM domains is the challenge and opportunities of a more digital future (WP15 – DITOCO2030). The newly developed tools can be used in many ways for planning, design, implementation, optimisation, evaluation and visualisation and documentation in the different steps of a waste management programme. It is also considered that digitisation can run horizontally through the program and in data management (WP2 – KM) to allow artificial intelligence and machine learning) (WP16 – HERMES).

RD&D needs to continue to exist on spent nuclear fuel management, including the understanding of the effect of long-term interim storage and damaged fuel on interim storage safety, transportability to a repository site and performance under repository conditions, including criticality issues (WP17 – CSFD), and the behaviour and insights into more special fuels (WP8 – SAREC) throughout the whole back end. Characterisation of all waste streams with a focus on safety-relevant radionuclides (WP5 – ICARUS) and studying the long-term behaviour of waste forms under repository conditions also remains (WP7 – L’OPERA, WP12 RAMPEC), to better understand key controls and limit uncertainties on the safety functions that could be associated with these waste forms.

For domains primarily concerned with the implementation of DGRs, but also in the further exploitation of (near) surface facilities (WP14 – SUDOKU), emphasis is reinforced on the continued optimisation of engineered barrier material and design concepts (WP13 – OPTI), particularly to enable the industrialisation of these facilities. The term optimisation in the context of implementing geological disposal facilities has widened from focusing initially on post-closure nuclear safety to many other aspects (WP11 – CLIMATE). Optimisation to implement geological disposal has thus become a multi-stakeholder and multi-objective challenge. The waste management concepts and designs (for different types of waste categories) require huge amounts of manmade and natural materials and related logistics and installation aspects. The performance of the materials is the most important aspect and is handled generally in the safety case (WP10 – ANCHORS, WP13 OPTI). Since disposal projects typically have very long timescales, the needs for updates in materials (WP9 – InCoManD) are required in several steps in order to guarantee and/or increase the performance. However, there might be other drivers. The sustainability and awareness of energy sources, and availability of raw materials are more critical in the current world situation. Thus, new environmentally friendly materials are required, exhibiting similar performance as materials historically considered in the safety cases for deep geological and surface repositories. (WP6 – STREAM, WP7 – L’OPERA, WP13 – OPTI).

Recognising the long timescales involved and the different paces in various European countries for implementing radioactive waste management, knowledge man-

agement remains critical and is considered a key enabler for supporting all national programmes (WP2 – KM, Task 2 integration in all WPs). Data gathered within EURAD as well as in previous EC programmes on radioactive waste management shall be accessible for the community, now and in the future, making sure these can be used in a quality productive way. This will not be a simple exercise and requires more effort. Challenges remain on accessibility to codified knowledge and information. A key message raised in this update is that KM in EURAD-2 should focus on competence development, making KM a more active state of mind (compared to a more passive “library collection of knowledge”) and improve understanding of relevant knowledge within a future EURAD that could lead the way to a real step-change for the community in this field.

Following on from the above messages related to KM, further reflections are shared relating to strategic directions a future EURAD can take in order to sustainably support the whole community and the different Member States (and their associated National Programmes) in driving innovation in research and technology, training new experts and ensuring transfer of knowledge. One aspiration is that EURAD could evolve to be the go-to place to structure and organise radioactive waste management competence, know-how and capabilities on a European scale, which includes the school for radioactive waste management as a European knowledge management (KM) platform and for training new young experts, a network of state-of-the-art research infrastructures (hot labs, URLs, etc.), acting as a think tank and writing position papers on important/emerging topics, with high visibility (nationally and internationally).

Finally, across all the work undertaken and pursued in the future it is reinforced that scientific excellence, not only excellence in scientific research, but also in all the activities implemented through Joint Programming, will support the credibility of results and contribute to the advancement of radioactive waste management in Europe (WP1 – PMO).

4 Conclusion

EURAD-2 has high ambition to address all the targets identified in the Euratom work programme. It builds on the successes of previous programs to create a comprehensive and collaborative approach to radioactive waste management in Europe. Its ambition is to be as driven by common needs as possible; therefore, the activities described will be complemented by new activities in the course of the programme to ensure the possibility of integrating any new emerging needs from the community. It also aims to maintain ongoing communication with the programme owners to ensure the effective impact and integration of results in the national programmes.

The cooperation with over 140 organizations from 28 countries involved in the programme is the cornerstone of joint programming. This extensive collaboration not only pools a vast array of expertise and resources but also fosters a unified approach to addressing the complex

challenges of radioactive waste management across Europe. By integrating diverse capabilities and knowledge from various Member States, EURAD-2 ensures a holistic and synergistic effort towards safe, responsible, and publicly acceptable, more sustainable solutions from cradle to grave. This collective endeavour enhances the scientific and technical foundation of radioactive waste management, promotes knowledge transfer across generations and regions, and drives innovative advancements that individual efforts might not achieve alone. Ultimately, it is this unparalleled level of cooperation that underpins the program's success and its ability to make significant, impactful strides in the field.

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