



EURAD Proposal
**European Joint Research Programme on
Radioactive Waste Management**

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Background – European RD&D

- ▶ For more than 40 years, considerable **scientific and technical knowledge** has been acquired in Europe in the field of radioactive waste management.
- ▶ Through **EURATOM**, EC has supported **EU collaborative RD&D ad-hoc projects** and enhanced **coordination** by supporting **IGD-TP** platform and **SITEX** network.
- ▶ **Leap forward: EC Policy and Strategy for integration of EU Member States (MS) R&D programmes**
 - ▶ Replace EU competitive calls for projects by **inclusive European Joint Programmes (EJP)**
- ▶ In 2014, EC called for a **feasibility study** of creating such an EJP in RWM field: **JOPRAD** (2015-2017)
 - ▶ **identified those actors** with key responsibility for directing RD&D and
 - ▶ engaged them in the development of a **shared Vision** and the basis for a **shared Strategic Research Agenda**
- ▶ **H2020 EURATOM WP2018** – EC called for the establishment of a Joint Programme on RWM (NFRP6) >>> **EURAD proposal**

EURATOM WP18 – NFRP6-2018

TOPIC : European Joint Research Programme in the management and disposal of radioactive waste

Topic identifier: NFRP-2018-6
Publication date: 27 October 2017

Types of action: COFUND-EJP COFUND (European Joint Programme)
DeadlineModel: single-stage
Opening date: 15 May 2018
Deadline: 27 September 2018 17:00:00

Time Zone : (Brussels time)



Horizon 2020
Pillar: Euratom Research and Training Programme 2014-2018
Work Programme Year: H2020-2018-2020
Work Programme Part: [Euratom Work Programme 2018](#)
Call : NFRP-2018

[H2020 website](#)

[Call budget overview](#)

available EURATOM budget for 5 years: 32,5M€
Funding rate: 55% (i.e. a total cost of ~59M€)

Topic Description

Specific Challenge:

In Europe, the challenges in the field of radioactive waste management (RWM) include:

- to increase knowledge for the safe start of operation of the world's first geological disposal facilities for high-level and long-lived radioactive waste / spent nuclear fuel in the advanced Member States within the next decade while also advancing all Member States national programmes as rapidly as possible in line with requirements under Directive 2011/70/Euratom and Commission report COM(2017) 236 final⁽¹⁾;
- to improve, innovate and develop science and technology for the management and disposal of other radioactive waste categories; and to manage and transfer knowledge and competences between generations and across Member States' national programmes.

Expected Impact:

In line with the objectives of Directive 2011/70/Euratom, this action should lead, within the next decade and across Europe, to the safe start of operation of the world's first geological disposal facilities for high-level and long-lived radioactive waste / spent nuclear fuel as well as improvement, innovation and development of science and technology for the management and disposal of other radioactive waste categories, in particular, radioactive waste streams for which industrially mature processes currently do not exist. Implementation of the action should result in greater cross-fertilisation and interaction between national programmes in key areas of general interest, improved knowledge management and transfer between actors. More particularly, EJP is a unique opportunity for less advanced programmes to benefit from integration process in the area of radioactive waste management.

Scope:

In view of the shared goals and clear scope for synergies in this field, the aim is to establish and implement a European Joint Programme (EJP) in the safe management and disposal of radioactive waste, bringing together a broad range of involved parties with scientific and technical responsibilities and a national mandate for research in RWM, and that are willing to pool resources in order to improve critical mass, efficiency and effectiveness in the implementing of solutions across Europe. "Mandated actors"⁽²⁾, which are nationally mandated for financing and implementing RD&D on radioactive waste management and disposal, shall be eligible for participation, as well as radioactive waste producers. The proposed EJP should follow on from the development work carried out as part of the Euratom JOPRAD project with extensive consultation of the Member States national programmes and the research community. The EJP will be co-funded via the Euratom programme, with reimbursement based on the total declared eligible costs of the partners. The EJP should be goal-oriented, with clear and agreed high-level milestones in order to enable easy monitoring of progress. The scope of the EJP should include all the scientific and technical areas and all the horizontal activities related to knowledge management covered in the SRA (Strategic Research Agenda) elaborated by JOPRAD. The SRA should enable joint research activities on the domains of management (pre-disposal) and disposal of radioactive waste (RW) defined in Directive 2011/70/Euratom. The SRA should be translated into a deployment strategy, or roadmap, with clear objectives, deliverables and high-level milestones for technical solutions per waste streams and waste types and on knowledge management. The roadmap may extend beyond the duration of the EJP, or the duration of support from the Euratom programme. A clearly defined roadmap and project-oriented approach to its implementation during the period of the EJP is expected to lead to the breakdown of the scientific and technical activities into work packages with specific projects, to which all involved parties (EJP partners) with the appropriate competences can participate. Projects should cover areas of interest for the small and large, advanced and less-advanced waste management programmes and should allow later inclusion of new partners. The projects should be defined by technical scope and should not be reserved for just one type of participant. An appropriate internal governance should be established through a consortium agreement, and include a 'programme office', to which staff from the partners can be seconded on a full-time basis. The 'programme office' will have a strategic role in ensuring implementation of the EJP as well as managing day-to-day activities. An appropriate means of allocation of project tasks and funding amongst the partners will need to be established on a yearly basis and take into account emerging Science and Technology (S/T) as well as Euratom research priorities. This action aims at the establishment of the European Joint Programme and open calls for proposals for third party grants are not necessary. The EJP should cover all related activities: common research and strategic studies, sharing of facilities, knowledge management, mobility and training of researchers. The involvement of external stakeholder groups should be designed into the governance mechanism, e.g. to enable Civil Society Organisations (CSOs) to advise and comment on activities. To maximise knowledge management and especially the impact on the smaller and less advanced national programmes, horizontal activities should be prioritised, including i) the development of State-of-the-art documentation (e.g. text books), guidance documents for planning and implementing research, ii) training courses organised, as appropriate, with European forums and activities on education and international organisations, and iii) hands-on-training via mobility measures. In addition, the EJP should be open to international R&D cooperation and the EJP managers would be expected to represent the EJP in areas of competence in international events and forums.

Source: <https://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/nfrp-2018-6.html>

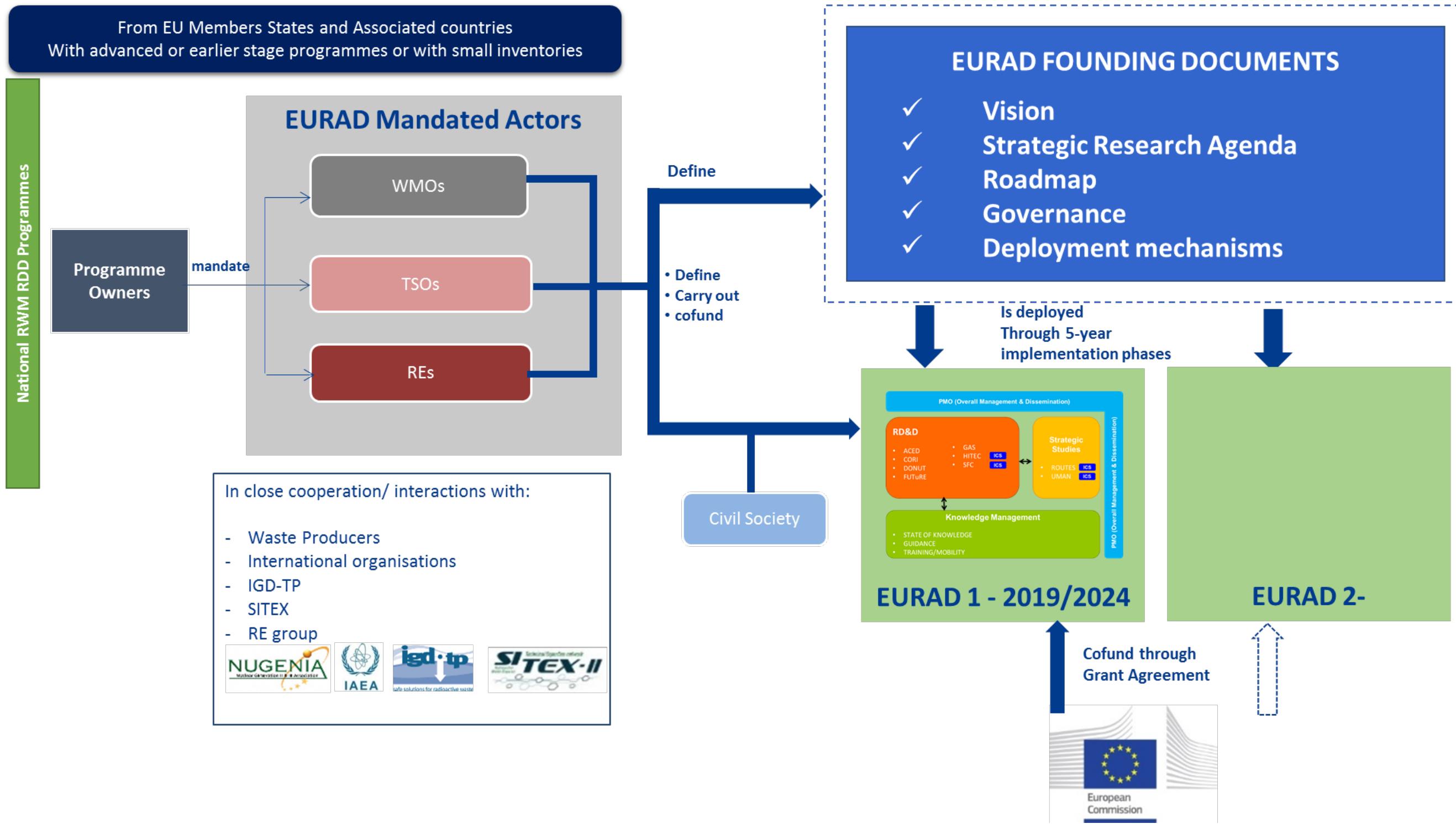
EURAD proposal submission



- ▶ Ministries have provided the **mandates** to those actors acting as **Beneficiary** within EURAD, recognising their role of directing RD&D at national level either as **WMO, TSO** or **RE**.
- ▶ Collective development with:
 - ▶ 3 preparation meetings with Mandated Actors:
 - ▶ 18 October 2017, Antony, France;
 - ▶ 27-28 February 2018, Berlin, Germany;
 - ▶ 11-12 June 2018, Madrid, Spain.
 - ▶ Several iterations and approval of **EURAD Founding Documents**: Vision, SRA, Roadmap, Governance, Deployment Plan.
 - ▶ Development of the **scientific and technical content of a 1st implementation phase** (2019-2024)
 - ▶ 7 **RD&D** projects
 - ▶ 2 **Strategic Studies**
 - ▶ **KM Programme**
- ▶ **Submission of EURAD proposal to EC on 27 September 2018**

EURAD Founding Documents

EURAD Overview



EURAD Participants

- ▶ **Ministries from 23 European countries** (21 MS and 2 Associated countries) provided **mandates** to those actors acting as **Beneficiary** within EURAD, recognising their role of directing RD&D at national level either as **WMO, TSO** or **RE**.
- ▶ 53 Mandated Organisations (*Beneficiaries*)
 - ▶ 20 WMOs
 - ▶ 13 TSOs
 - ▶ 20 REs
- ▶ 56 organisations linked to a Mandated Organisation (*Linked Third Parties*)
 - ▶ Mainly research entities, consulting groups



EURAD Mandated Actors (Beneficiaries)



Waste Management Organisations

Whose mission covers the management and disposal of radioactive waste



Technical Support Organisations

Providing technical / scientific basis for supporting decisions made by regulatory bodies



Research Entities Working on the RWM challenges under the responsibility of MS



EURAD also involves **key interest group** that may benefit from, or influence direction of specific activities undertaken:

- Waste Producers 
- International Organisations 
- Civil Society Organisations
- Third Countries

EURAD Vision and goals



Vision

A step change in European collaboration towards safe radioactive waste management (RWM), including disposal, through the development of a robust and sustained science, technology and knowledge management programme that supports timely implementation of RWM activities and serves to foster mutual understanding and trust between participants.

Goals

Support the implementation of the [Waste Directive](#) in EU Member-States (MS), taking into account the various stages of advancement of national programmes:

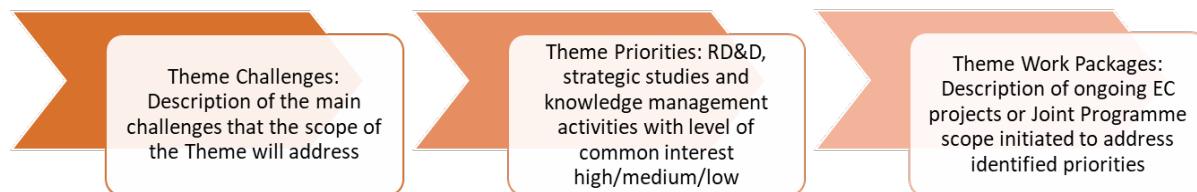
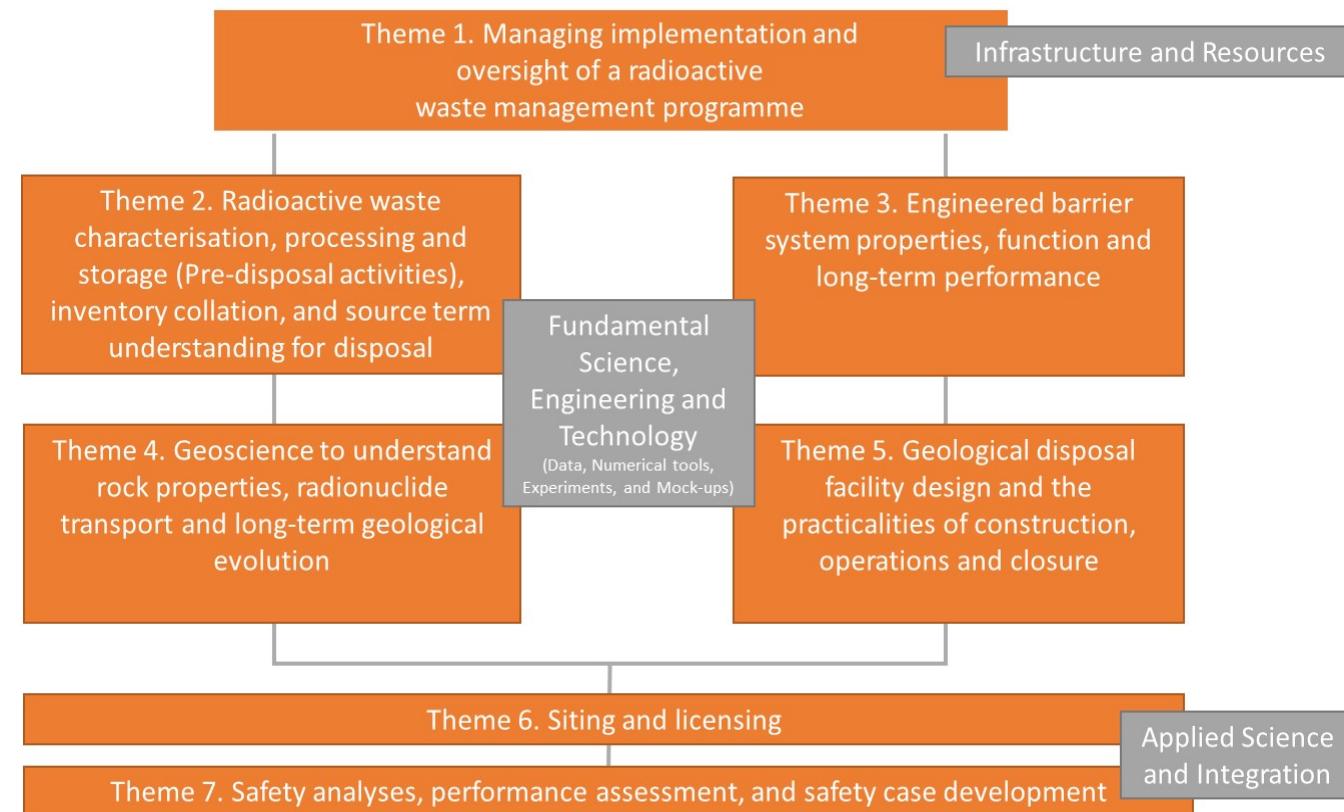
- ▶ Support MS in developing and implementing their national RD&D programmes for the safe long-term management of their full range of different types of radioactive waste;
- ▶ Develop and consolidate existing knowledge for the safe start of operation of the first geological disposal facilities for spent fuel, HLW, and other long-lived radioactive waste, and supporting optimization linked with the stepwise implementation of geological disposal;
- ▶ Enhance knowledge management and transfer between organisations, MS and generations.

EURAD Strategic Research Agenda (SRA)

Scope

- ▶ Scientific and technical activities on RWM from cradle to grave (excluding dismantling and decommissioning of nuclear facilities):
 - ▶ Radioactive waste characterisation and processing (incl. treatment, conditioning and packaging);
 - ▶ Interim storage of radioactive waste; and
 - ▶ Disposal solutions – mainly geological disposal of spent fuel, HLW and long-lived ILW.

- ▶ The SRA provides a description of scientific & technical activities needs of common interest between the actors
 - ▶ Is structured by 7 scientific themes, delineated into topics and sub-topics



EURAD SRA and Roadmap

EURAD SRA

Theme 1 Managing implementation and oversight of a RWM programme	<ul style="list-style-type: none"> • Programme planning • Organisation • Resources
Theme 2 Radioactive waste characterisation, processing and storage and source term understanding for disposal.	<ul style="list-style-type: none"> • Waste handling, characterisation, treatment, packaging • Interim storage • Transportation between facilities • Radionuclide inventory and source term • Waste acceptance criteria • Multi-national, regional or shared facilities
Theme 3 EBS properties, function and long-term performance.	<ul style="list-style-type: none"> • Spent Fuel and high-level waste disposal canisters • Containers for LLI and LLW • Clay-based backfills, plugs and seals • Cementitious-based backfills, plugs and seals • Salt backfills • EBS system understanding
Theme 4 Geoscience to understand rock properties, radionuclide transport and long-term geological evolution.	<ul style="list-style-type: none"> • Long-term stability (uplift, erosion and tectonics) • Perturbations (gas, temperature and chemistry) • Aqueous pathways and radionuclide migration
Theme 5 Facility design and the practicalities of construction, operations and closure.	<ul style="list-style-type: none"> • Facility and disposal system design • Constructability, demonstration and verification testing • Health and safety during transport, construction, operations and closure • Monitoring and retrievability
Theme 6 Siting and licensing.	<ul style="list-style-type: none"> • Site selection process • Detailed site investigation • Licensing
Theme 7 Performance assessment, safety analyses and safety case development	<ul style="list-style-type: none"> • Integration of safety-related information • Performance assessment and system models • Treatment of uncertainties

Phase 0: Policy, framework and programme establishment
Includes conceptual design and preliminary safety analyses

Phase 1: Site evaluation and site selection
Includes preliminary site(s) design and generic safety case(s)/analyses

Phase 2: Site characterisation
Includes detailed design and site safety case/analyses for construction license

Phase 3: Facility construction;
Includes final design and site safety case/analyses for operational license

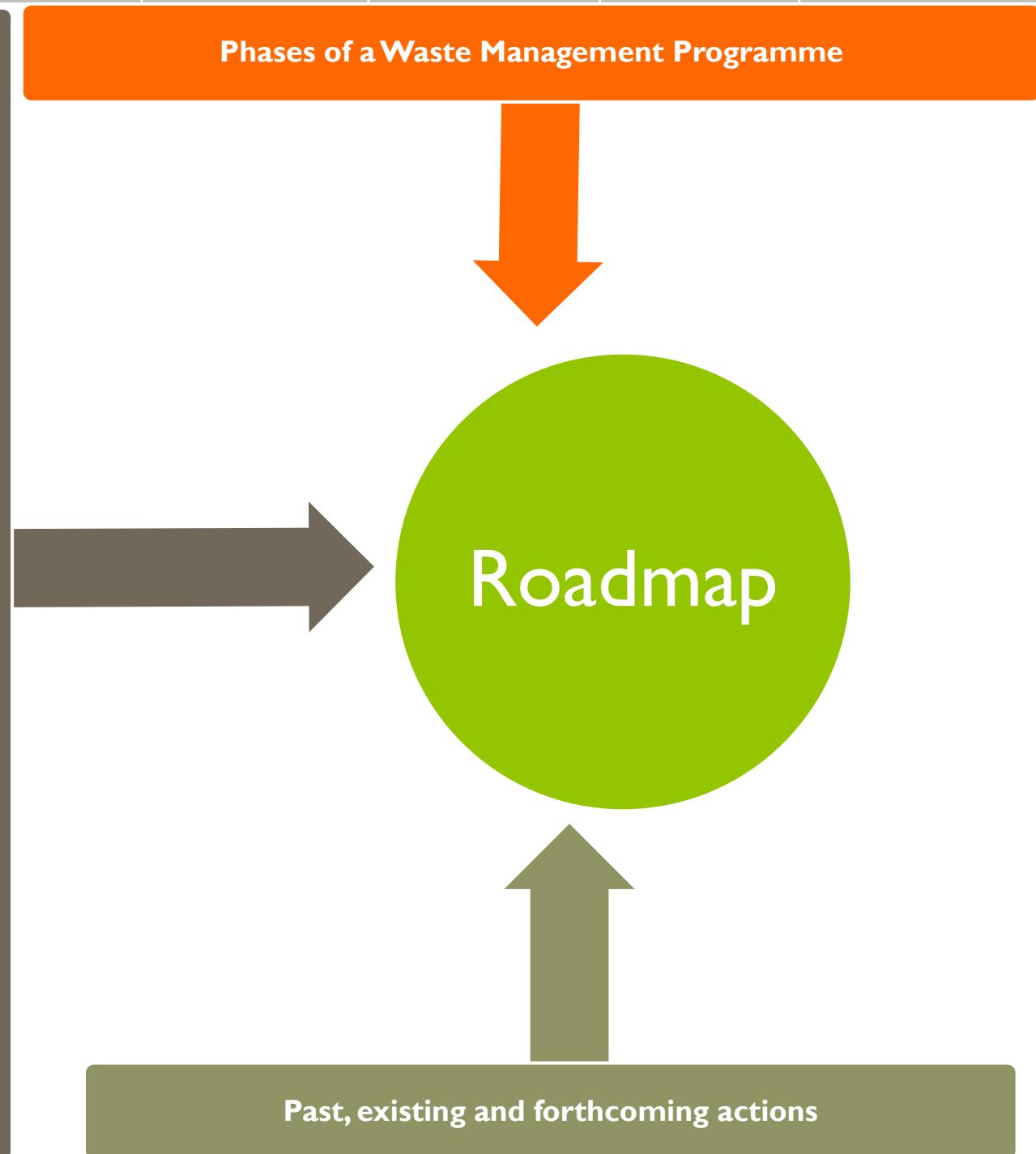
Phase 4: Facility operation and closure
Includes maintenance and update of license documentation, as required

Phases of a Waste Management Programme

SRA Themes Topics & sub-topics

Roadmap

Past, existing and forthcoming actions



Roadmap

Roadmap Theme 2: JP Priorities and Activities of Common Interest that relate to Radioactive waste characterisation, processing and storage (Pre-disposal activities), and source term understanding for disposal

	Phase 0: Policy, Framework & Programme Establishment	Phase 1: Site Evaluation & Selection	Phase 2: Site Characterisation	Phase 3: Facility Construction	Phase 4: Facility Operation and Closure
Theme 2 Radioactive waste characterisation, processing and storage (Pre-disposal activities), and source term understanding for disposal Topics:	Includes conceptual design and preliminary qualitative safety analyses	Includes preliminary site(s) design and generic safety case(s) / analyses	Includes detailed design and site safety case / analyses for construction license	Includes final design and site safety case / analyses for operational license	Includes maintenance and update of license documentation, as required
	<ul style="list-style-type: none"> Develop, and maintain national waste inventory (characterization, documentation of waste being produced and estimates for future arisings). 				
	<ul style="list-style-type: none"> Provide input to evaluation of disposal options (waste inventory for planning purposes and to scope preliminary design options and safety analyses). Develop guidance for waste treatment (preliminary waste acceptance criteria) for the different waste disposal routes. Where necessary, develop new waste treatment methods and input to the development of the corresponding waste treatment facilities. 	<ul style="list-style-type: none"> Adjust waste treatment guidance (preliminary waste acceptance criteria) according to new findings, taking results from site evaluation into account (optimization for safety and other issues (incl. cost)). Refine radionuclide source term treatment and understanding of waste package performance to account for understanding of a prospective/ selected site. Provide inventory and source term understanding for construction license. Develop waste acceptance criteria for construction license. 		<ul style="list-style-type: none"> Transform waste treatment guidance into draft waste acceptance criteria and adjust them according to detailed repository layout (optimization for safety and other issues (incl. cost)). Provide inventory and source term understanding for operational license. 	<ul style="list-style-type: none"> Organize logistics (delivery of waste to repository) and enforce compliance of waste accepted for disposal with waste acceptance criteria in force Ensure compliance with safeguards Maintain national waste inventory and maintain detailed documentation on wastes emplaced in the repository Modify waste acceptance criteria when appropriate to take optimization for safety and other issues (incl. cost) into account. Provide detailed information (incl. documentation) for closure license.
Waste handling, characterisation, treatment and packaging	<p>1.2.4 Management of damaged waste packages H2020 Project DISCO</p> <p>3.7 Links between waste producers & implementers</p> <p>J1.1.3 Novel conditioning methods for problematic wastes. H2020 Project THERAMIN</p> <p>Waste management routes across Europe EJP1 WP ROUTES</p>		<p>J1.1.7 Improved understanding of the nature and quantities of the likely chemotoxic component of common decommissioning wastes. </p> <p>J1.1.2 Technology for characterisation & segregation of historical wastes. H2020 Projects CHANCE, INSIDER & THERAMIN </p> <p>J1.1.8 Optimisation of novel waste treatment techniques. EJP1 Project SFC </p>		
Interim storage	<p>3.10 Long-term storage for disused seals radioactive sources</p> <p>2.4.5 Operational lifespan of interim storage</p>				
Transportation between facilities					
Radionuclide inventory and source term	<p>3.6 Methodologies applied to refine inventory</p> <p>3.5 Inventory collation</p> <p>J1.1.1 Inventory data and uncertainty treatment. EJP1 WP SFC</p> <p>J1.1.10 Quantification of fissile content of spent fuels. </p>	<p>J1.2.2 Improved understanding of the performance of the final waste package (including the waste form) during prolonged storage prior to its transport and disposal. </p> <p>J1.1.9 Improved understanding of radionuclide release from wasteforms other than spent fuel. </p> <p>J1.1.4 Improved understanding of radionuclide release from spent fuel, inc. fire and impact. H2020 Project DISCO & EJP1 WP SFC </p> <p>J1.1.5 Demonstration of geopolymer performance in representative disposal conditions. </p> <p>J1.1.8 Fourth generation (Gen(IV)) wastes </p>	<p>1.4.2 Improved understanding of the generation and release of radioactive trace gases and bulk gases from wasteforms and waste packages. </p>		
Waste acceptance criteria			<p>2.1.6 Waste acceptance criteria </p>		

Programme Objectives
Collaborative RD&D
Strategic Studies
Knowledge Management Activities

High Priority
 Medium Priority
 Low Priority
 Future
 Currently In Progress

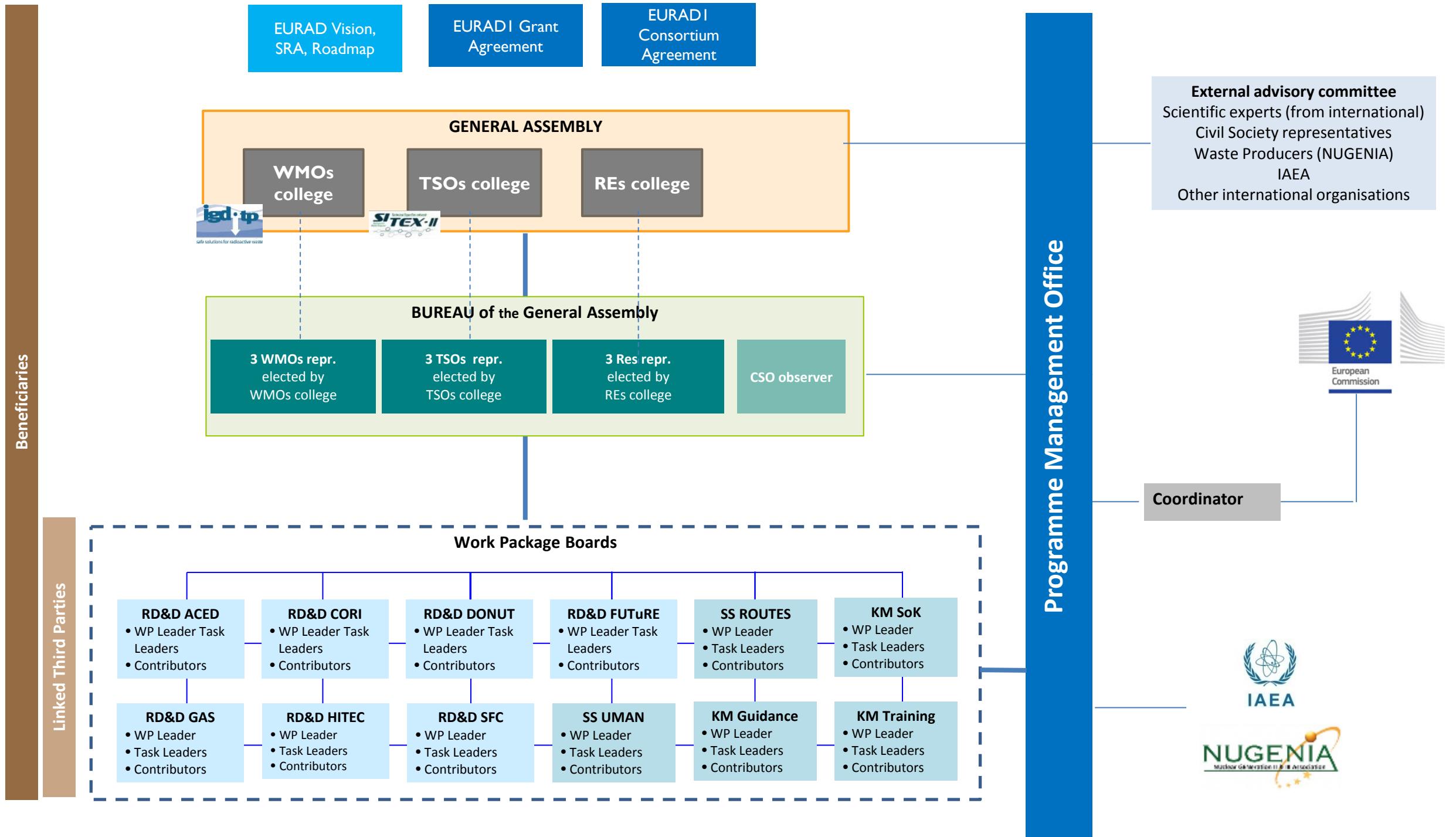
EURAD Deployment mechanisms

- ▶ EURAD SRA and Roadmap will be delivered **through implementation phases of 5 years** and thanks to the following **types of activities**:

Collaborative RD&D	<p>Developing and consolidating scientific and technical knowledge.</p> <ul style="list-style-type: none"> - operational RD&D (direct links with implementation of deep geological disposal or other waste management route as well as safety concerns) - prospective RD&D (experiment and/or modelling works to demonstrate the robustness of the waste management concepts, to increase understanding and predictability of the impact of fundamental processes and their couplings). 	<p><i>State-of-the-art (initial and update), S/T deliverables, reports, demonstrator, pilot, prototype, plan designs, software, technical diagram...</i></p>
Strategic Studies	<p>Enabling experts and specialists to network on methodological/ strategical issues and advance significant challenges that are common to various national programmes and that are in direct link with scientific and technical issues.</p>	<p><i>Position paper (e.g. emerging needs for future RD&D/Strategic Studies/KM activities), report on generic methodologies, best practices...</i></p>
Knowledge Management	<p>Actions consisting of developing State of Knowledge; developing descriptive methodological guidance and developing/delivering Training modules and mobility measure.</p>	<p><i>State-of-knowledge documents; Guidance documents, Training delivery and materials...</i></p>
Programme Management Office	<p>Scientific and technical coordination/integration of the overall JP (monitoring EURAD progress, day-to-day administration, reporting exercises, interactions with EC, communication and dissemination activities).</p>	<p><i>Management tools, Periodic reports, financial statements, website, platforms...</i></p>

- ▶ **Interaction with Civil Society Organisations (CSOs)** as a cross-cutting activity directly embedded within RD&D and Strategic Studies in order to facilitate the translation of scientific/technical results and create the conditions for CSOs to interpret, discuss on EURAD technical progress (and results), and express their expectations or views.

EURAD Governance



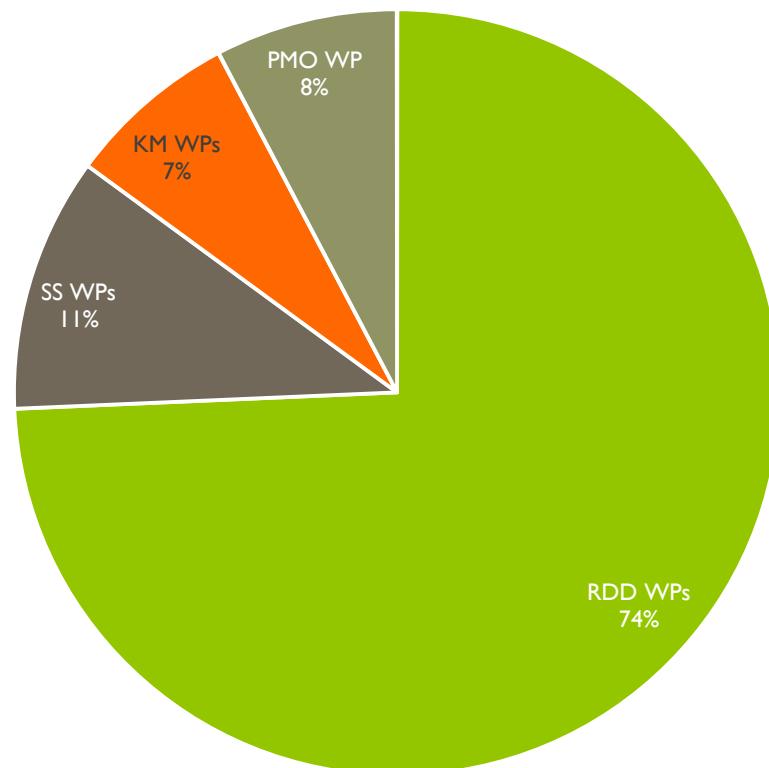
EURAD Governing principles

- ▶ **Positive Participation** towards achievement of the EURAD Vision.
- ▶ **Maintenance of Independence** between the “expertise function” (fulfilled by TSOs and by some Research Entities) and the “implementer function” (fulfilled by WMOs).
- ▶ **Transparent, balanced and efficient mode of Governance**
- ▶ RD&D activities shall focus on achieving passive safety and reducing uncertainties through **excellence in science**.
- ▶ **Balanced Programme** that supports programmes at all stages of advancement
- ▶ **Added Value**
- ▶ **Inclusiveness**
- ▶ **Equitable Financing**
- ▶ **Participation complementary** to RD&D activities which will continue to be undertaken nationally or jointly outside of the auspices of EURAD
- ▶ Scope is appropriately prioritised and focused on the objective to achieve **tangible results** within a reasonable timeframe

EURAD First Implementation phase (EURAD1 – 2019 - 2024)

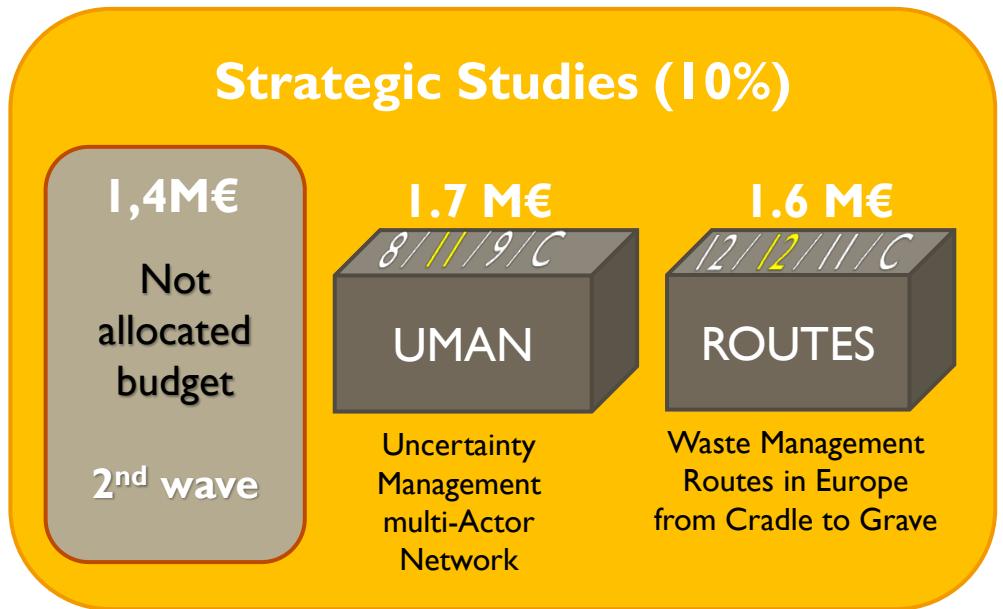
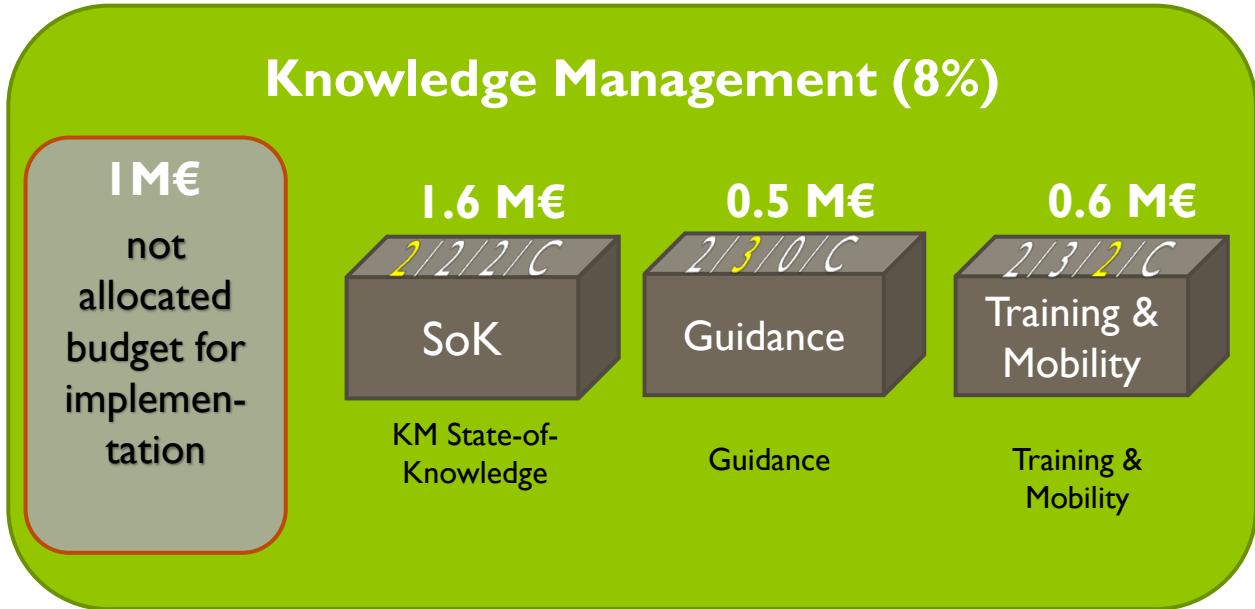
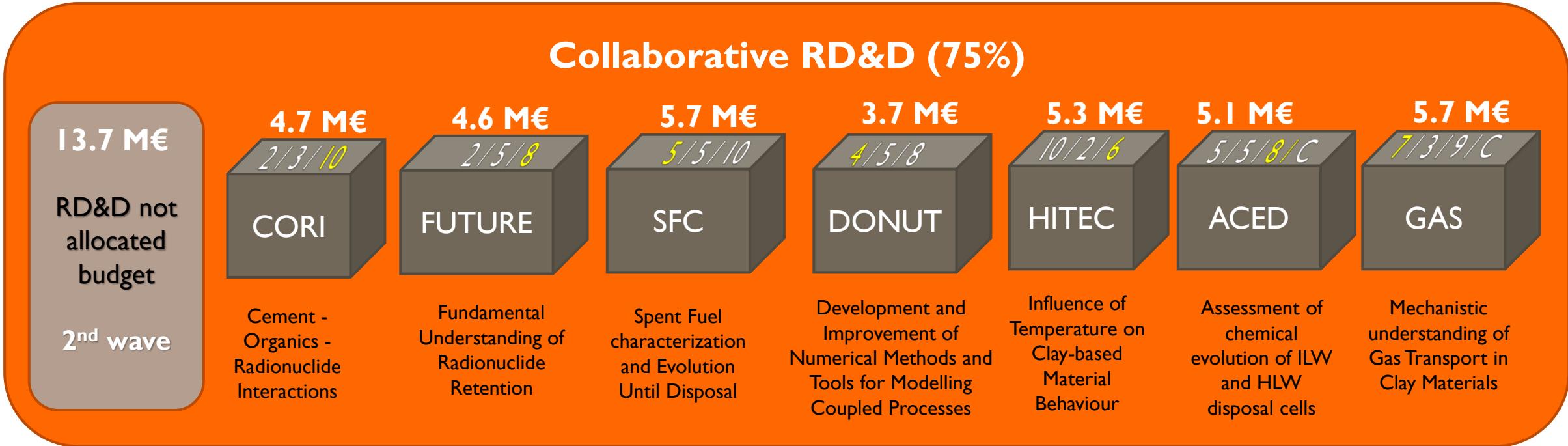
EURAD Deployment

- ▶ EURAD SRA and Roadmap will be delivered **through implementation phases of 5 years.**
- ▶ 1st implementation phase (EURADI): **2019 - 2024**
 - ▶ Available EURATOM contribution: **32,5M€**
 - corresponding to 55% of the total eligible costs
 - Distributed as follows:



EURAD1 Overview

Programme Management office (7% - 2.5 M€)



Next steps

Feb. 2019

Results of the Call EURATOM WP2018

If positively evaluated:

Feb/June 2019

Granting period (Grant Agreement/ Consortium Agreement)

June 2019

Launch of EURAD

Start of the 1st implementation phase (2019-2024) - EURAD-I

June 2021

Launch of 2nd wave of EURAD-I

May 2024

End of EURAD-I



Conclusions

- ▶ **EJP = Flexible & sustainable mode of European research collaboration**
 - ▶ that supplements /enhances national programme capabilities to address remaining scientific and technical (S/T) challenges.
- ▶ More than 3 years of **fruitful cooperation** between **WMOs, TSOs, REs & CSOs**
 - ▶ from 23 European countries with RWM programmes at different stages of implementation

to **develop a shared Vision, SRA and Roadmap** with a **broad spectrum** of S/T needs and drivers that recognise the important role that each **stakeholder group**:

 - ▶ Developing and consolidating S/T knowledge through **operational** and **prospective RD&D**;
 - ▶ Networking on **strategical issues and significant challenges in link with RD&D** that are common to various national programmes;
 - ▶ Developing **state-of-knowledge**; descriptive methodological **guidance** and **training/mobility**.
- ▶ This includes close **interaction** between experts from different backgrounds and close **cooperation** with **international organisations** such as IAEA, NEA, NUGENIA, ENEN...
- ▶ Initial Implementation Phase (EURADI): 2019-2024
- ▶ Submitted to EC in Sept. 2018 - Results of evaluation expected in Feb. 2019
 - ▶ If positively evaluated, could be launched in June 2019 after the granting period

Thanks for your attention!

For further information, do not hesitate to contact:

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EURAD - Linked Third Parties (LTP)

- ▶ Beneficiaries (Mandated Actors) embarked the following organisations as LTP to deliver the planned work in the WPs:

LTP Acronym	country	Linked to Beneficiary
EIG Euridice	BE	ONDRAF/NIRAS
Uliege	BE	ONDRAF/NIRAS
UBERN	CH	NAGRA
EPFL/LMS	CH	NAGRA
ZHAW/ICP	CH	NAGRA
CIMNE/UPC	CH	NAGRA
EMPA	CH	PSI
CTU	CZ	SURAO
CU	CZ	SURAO
IGN	CZ	SURAO
TUL	CZ	SURAO
UJV	CZ	SURAO
DMT	DE	NCSR Demokritos
HZDR	DE	FZJ
GFZ	DE	FZJ
UFZ	DE	FZJ
BAM	DE	KIT PTKA
BGR	DE	KIT PTKA
JGU INC (UMAINZ)	DE	KIT PTKA
TU Clausthal	DE	KIT PTKA
UPOTSDAM	DE	KIT-PTKA
PEL	DE	KIT PTKA
Aalto University	FI	University of Helsinki
TUT	FI	University of Helsinki
JYU (University of Jyväskylä)	FI	University of Helsinki
GTK	FI	University of Helsinki
Envirocase Oy	FI	POSIVA

LTP Acronym	country	Linked to Beneficiary
BRGM	FR	Andra
EDF	FR	CEA
ORANO	FR	CEA
IMT Atlantique	FR	CNRS
UGrenoble	FR	CNRS
ULille	FR	CNRS
ULorraine	FR	CNRS
UMontpellier	FR	CNRS
UNice	FR	CNRS
UOrleans	FR	CNRS
UPoitiers	FR	CNRS
MINES ParisTech	FR	IRSN
MUTADIS	FR	IRSN
NTW	FR	IRSN
SORC	HU	MTA EK
TU Delft	NL	COVRA
Uppsala University	SE	SKB
EIMV	SL	JSI
ZAG	SL	JSI
ENUSA	SP	ENRESA
UDC	SP	ENRESA
UPM	SP	CIEMAT
UAM	SP	CIEMAT
UPC	SP	CIEMAT
CSIC	SP	CIEMAT
IDOM	SP	CIEMAT
A21	SP	KIT-PTKA
KIPT	UA	CHRDI
SIIGNASU	UA	CHRDI
GSL	UK	VTT