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## EURADSCIENCE the grouping and vision of European research entities in the first European Joint Programme

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EURADSCIENCE  
the grouping  
and vision of European research entities  
in the first European Joint Programme

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SUBATECH/SCK-CEN

# 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

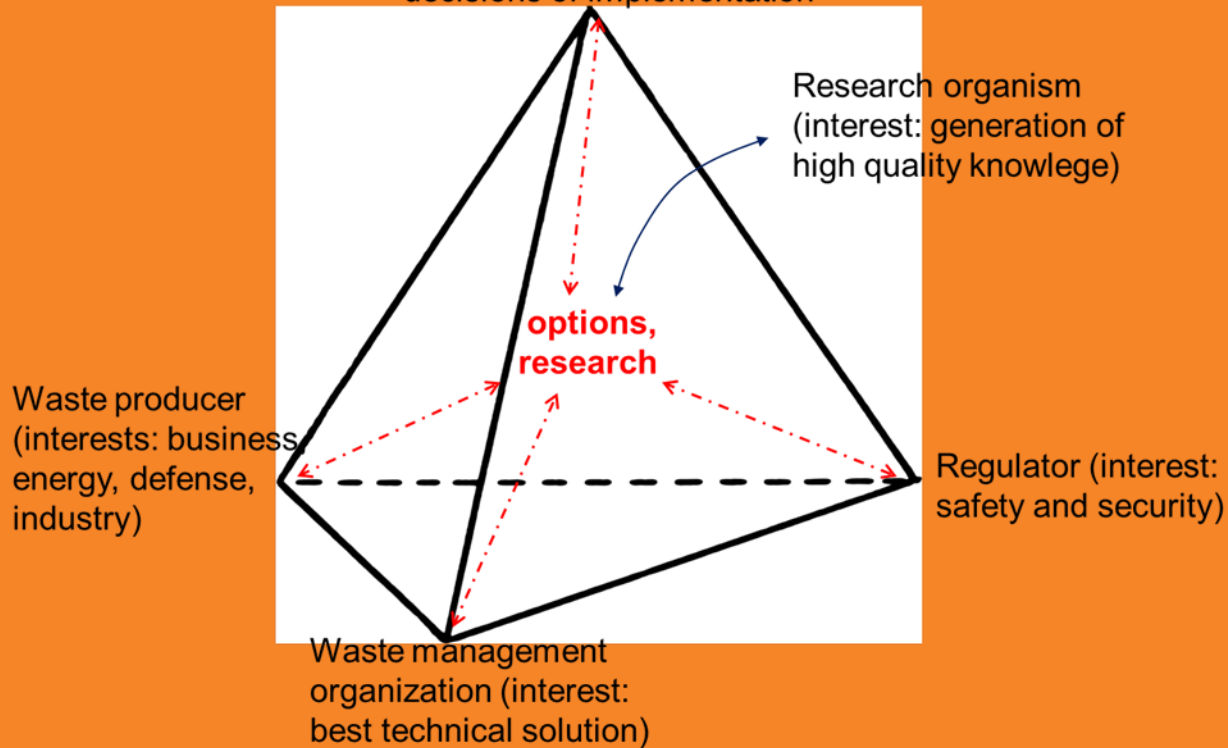
Support the implementation of the [Waste Directive](#) in EU Member-States (MS), taking into account the various stages of advancement of national programmes:

- 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.

# The role of research entities

## A schematic vision on separation and role of actors

General and local public interest:  
parliamentary offices, government, regions  
assure procedures, review, transparency  
decisions of implementation



# RE grouping within JOPRAD on the feasibility of a European Joint Programming

- Networks IGDTP and SITEX orientated their work in the feasibility study by their Strategic Research Agendas (SRA)
- Associated to the JOPRAD project, REs grouped to define their own SRA in record time form 2015-2016
- RE working group (22 partners)
  - Advanced and less advanced programs

<i>Organisation</i>	<i>Country</i>
CNRS, CEA, IMT, INIRIS, UPMC, U-Lorraine	France
CTU, UJV-REZ	Czech Republic
SCK.CEN	Belgium
HGF (Jülich, Karlsruhe, Dresden)	Germany
ENEA, INFN	Italie
LEI	Lithuania
U Delft/TNO	Netherlands
RATEN/INR	Romania
TU Sofia	Bulgaria
ITU	JRC
PSI	Switzerland
IST	Portugal
Geo ZS	Slovenia

# EURAD SRA and Roadmap

Shared between RE, WMO and TSO

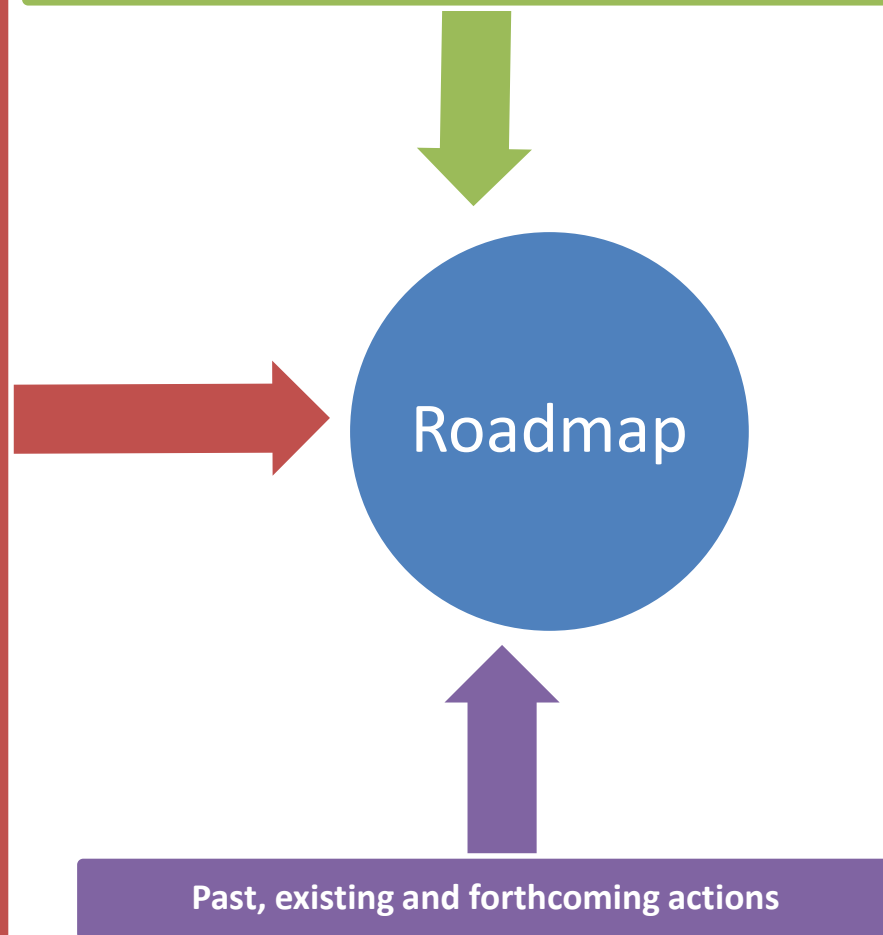
Phase 0: Policy, framework and programme establishment	Phase 1: Site evaluation and site selection	Phase 2: Site characterisation	Phase 3: Facility construction;	Phase 4: Facility operation and closure
<i>Includes conceptual design and preliminary safety analyses</i>	<i>Includes preliminary site(s) design and generic safety case(s)/analyses</i>	<i>Includes detailed design and site safety case/analyses for construction license</i>	<i>Includes final design and site safety case/analyses for operational license</i>	<i>Includes maintenance and update of license documentation, as required</i>

## EURAD SRA

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

SRA Themes Topics & sub-topics

## Phases of a Waste Management Programme

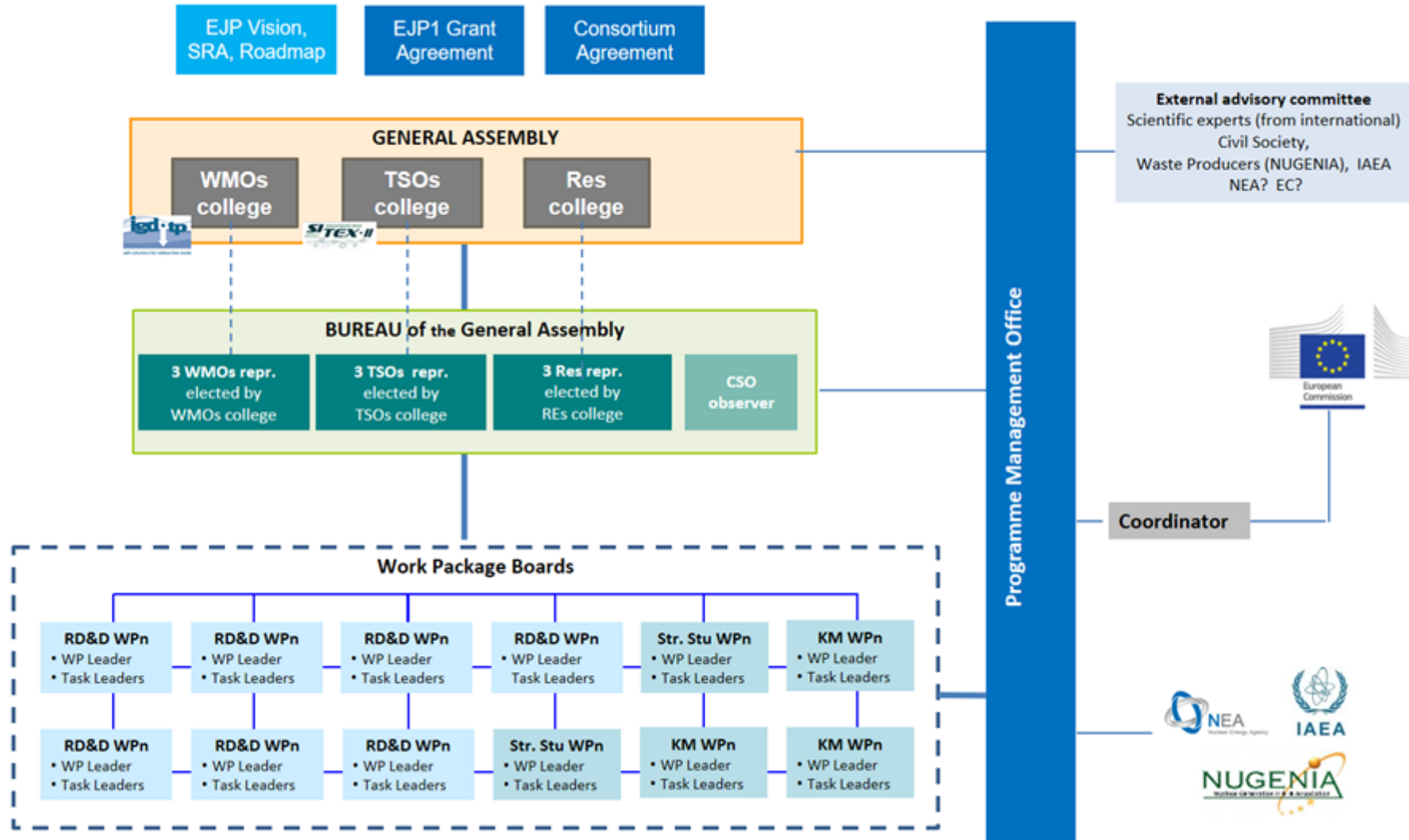


Roadmap

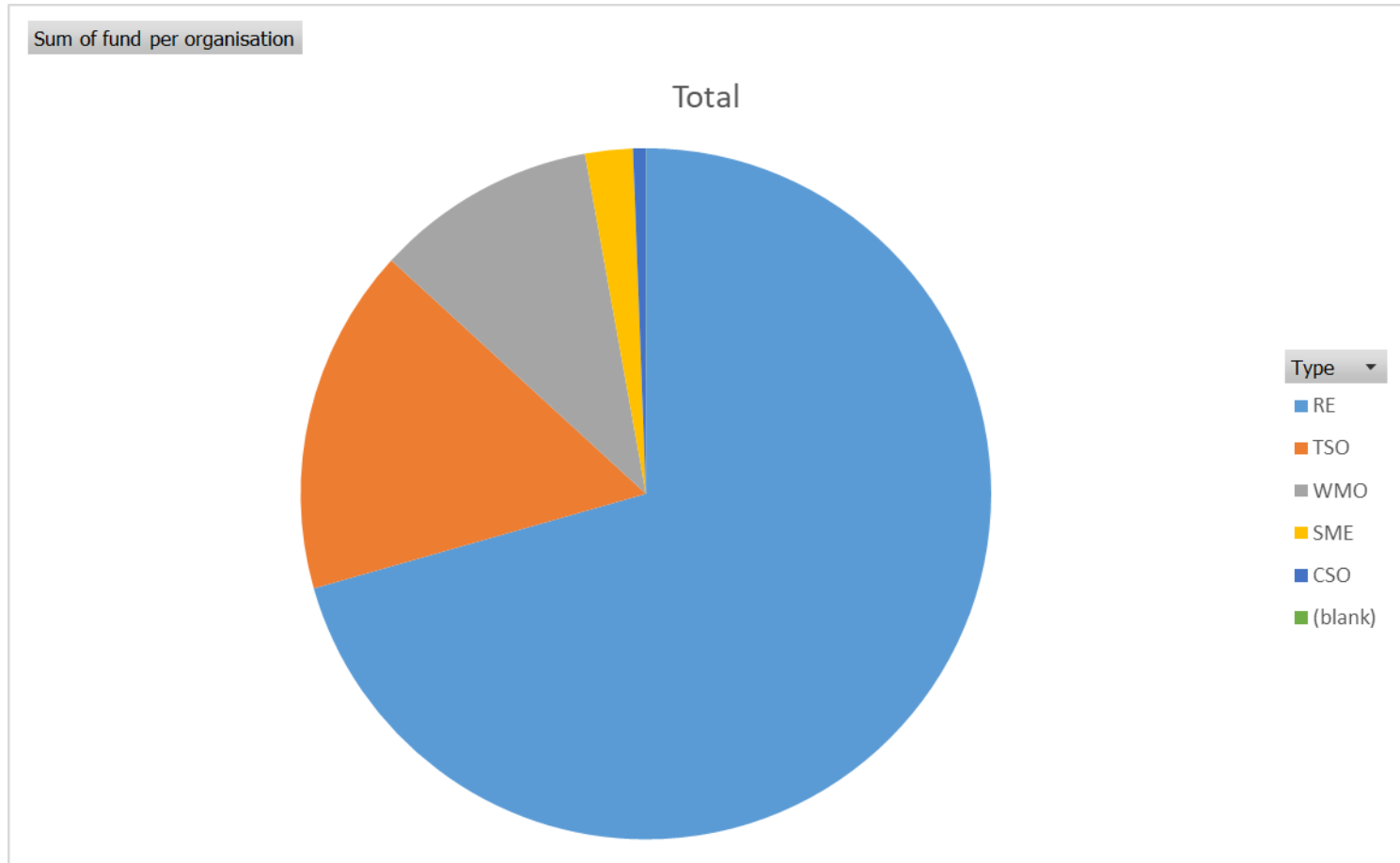
Past, existing and forthcoming actions

# EuradScience: importance to organise RE college for EURAD Governance

Beneficiaries, Linked Third Parties



# Financial analysis of budget splitting





# REs in EURAD

- REs as LTPs
  - 59 LTPs, mostly defined as “research organisations”
    - National research centres, universities, waste producers
    - Some LTP linked to WMO: BRGM...
- Some research organisations mandated as TSO
  - VTT, CIEMAT

# A network of research entities

## “EuradScience”

- REs are at the center of long term knowledge management and further development of applied and fundamental research on radioactive waste management beyond national borders
  - Link to Council Directive 2011/70/Euratom (see next slide)
- Inherent role of R&D (scientific and technical challenges) in waste management and disposal
  - Providing credibility
  - Providing scientific excellence
- Maintaining competence; providing for the next generation experts and for E&T of new generation of scientists
  - Through promotion of attractive and frontier research
  - By networking for maintaining and developing infrastructure and expertise
- Preparing for EURAD role (RE college in the Bureau of EURAD)
  - Complement IGD-TP and SITEX with own accents and needs

# EuradScience

- First discussion June 2018 (Brussels)
  - Interest of ~20 research entities
- Meeting October 2018 with smaller group to prepare the meeting in December 2018 (Berlin)
  - 6 organisations (FZJ, KIT, PSI, JRC, CNRS, SCK)
- Founding Meeting December 2018 (Berlin)
  - 17 organisations declared to participate
  - Additional 7 showed interest (before and during IGD-TP)
  - Open for RE from EURAD and beyond (Mandated actors, LTP, RE declared as TSO or WMO LTP, others)
  - Today: 27 participating organisations

1 Belgian Nuclear Research Center, SCK•CEN, Boeretang 200, 2400 Mol (Belgium)  
2 CNRS,  
3 Forschungszentrum Jülich, 52425 Juelich (Germany)  
4 Technical University of Liberec, Studentsak 2, Liberec (Czech Republic)  
5 National Nuclear Laboratory, 5th Floor, Chadwick House, Warrington Road Birchwood Park,  
6 British Geological Survey (BGS), Nicker Hill, Keyworth, Nottingham (UK)  
7 Helmholtz-Zentrum Dresden-Rossendorf, Bautzner Landstrasse 400, Dresden (Germany)  
8 VTT Technical Research Centre of Finland Ltd, Box 1000, VTT 02044 (Finland)  
9 Independent (Sweden)  
10 Centrum vyzkumu Rez (CV REZ) s.r.o., Rez (Czech Republic)  
11 Paul Scherrer Institute (PSI), Forschungsstrasse 111, CH-5232 Villigen PSI (Switzerland)  
12 Karlsruhe/KIT; Hermann von Helmholtz Platz 1; 76344 Eggenstein-Leopoldshafen (Germany)  
13 Safety and Environmental Engineering Laboratory, Technical University of Sofia (Bulgaria)  
14 Center for Nuclear sciences and technologies, Technical university of Lisboa, Lissabon (Portugal)  
15 Fuel cycle chemistry department, UJV Rez, Hlavni 130, 250 68 Husinec - Rez (Czech Republic)  
16 DG Joint Research Centre  
17 KIT-INE, Karlsruhe (Germany)  
18 Centre for Energy Research, Hungarian Academy of Sciences (Hungary)  
19 Department of Chemistry, University of Helsinki, A.I.Virtasen Aukio 1, Helsinki (Finland)  
20 TNO, Utrecht (The Netherlands)  
21 RATEN  
22 Galson science  
23 Brenk Systemplanung  
24 Amphos21  
25 CEA  
26 CTU Prague  
27 IMT Atlantique  
28 BRGM?

# Dual Role of EuradScience

- EuradScience as influencer on a European level
  - Creating a visible community, connecting the players, creating a vision
  - Promoting the advancement of knowledge and scientific excellence
    - Delineating the state of the art
    - Endorsing a joint vision on research needs and priorities
  - Networking on research infrastructures
  - Lobbying for increased role of fundamental (non-implementation driven) RD&D
  - Interaction with other networks
  - Inclusiveness and transparency
- EuradScience as the platform for the RE college within EURAD
  - Preparing decisions to be taken by General Assembly
    - Evaluation of proposals for new WPs
  - Preparing the Bureau meetings
  - Preparing the election of Bureau representatives
  - Voting rights restricted to mandated actors in and outside of EuradScience

# EURAD Bureau elected composition

*EURAD Bureau Members from Month 1 to Month 30*

<b>First Name</b>	<b>Last Name</b>	<b>Organisation</b>	<b>Country</b>	<b>College</b>
Dirk	Bosbach	FZJ	Germany	RE
Christophe	Bruggeman	SCK•CEN	Belgium	RE
Crina	Bucur	RATEN	Romania	RE
Valéry	Detilleux	Bel V	Belgium	TSO
Suvi	Karvonen	VTT	Finland	TSO
Ole	Kastbjerg Nielsen	Dekom	Denmark	WMO
Stéphan	Schumacher	Andra	France	WMO
Ferenc	Takats	TS Enercon	Hungary	TSO
Patrik	Vidstrand	SKB	Sweden	WMO
<i>Observer from Civil Society Organisations still to be appointed</i>				-

# Executive group of EuradScience

- “Executive group” to prepare the work ahead
  - Preparing documents, meetings, decision making process: Enabling to move forward
  - Guarding the vision and values endorsed by EuradScience
  - Ensuring communication between all members and with Eurad
  - Commitment needed
- Executive group to receive mandate from EuradScience network
- EuradScience network makes final decision
  - Limited to RE college members for Eurad-Bureau

# Legal structure

- No priority
  - → Getting things moving first.
- Participation fee?
  - ✓ Allows to increase visibility: webpage, marketing, etc.
  - ✓ Scientific secretariat
  - ✓ Meetings/working group activities
  - ✓ Ensures commitment
    - ✓ Limited to Executive Group?
    - ✓ Different fees for EG and other members?
  - ✓ Increases professionalism



# RE-SRA (JOPRAD)

- Demonstrating safety and environmental protection of radioactive waste disposal facilities is associated with prominent scientific-technical long-term challenges
  - Unique challenges in the history of science
  - Stringent demands to prevent migration of radiotoxic material to the environment limiting the quality of life for future generations
  - Complexity of disposal system and its components
    - Spatial scale features from nm to km
    - Time scale features from s to Myears
    - Multi-disciplinarity
    - Process coupling
  - Time-scales for implementing geological disposal
  - Credibility of safety assessments

# Updating the JOPRAD RE-SRA

- Focus shift from “geological disposal” (JOPRAD) to “from cradle to grave” (nuclear back-end, EURAD), including
  - Pre-disposal activities
  - Legacy waste, including small (problematic) inventories
  - (Near-)surface disposal
  - (New) nuclear developments
- Providing and developing cutting-edge nuclear research facilities and instrumentation (for applied and fundamental scientific studies)
- Attracting young scientists’ interest (educating and training of next generation experts)
- Re-thinking priorities in view of EURAD road map

# Updating the JOPRAD RE-SRA

- Some examples
  - Innovative waste forms (ceramic, geopolymers, plasma, spray coatings, organo-mineral composites, etc.)
  - Natural analogues/site-specific analogues
  - Biosphere models: how to increase credibility?
  - Transparent and quality assured thermodynamic databases
  - Linking bottom up to top down approaches in complex systems, including mineral assemblages, competition effects, micro-organisms, redox, colloids
    - Including scale up and multi physics models
  - Develop and evaluate concepts and methods for handling, characterization, treating, conditioning, storing and re-disposal of historical (very old) wastes
    - Also in view of retrieval
  - Integral experiments with high-level waste
  - Deep Borehole disposal
  - Atomistic simulations
  - Networking and sustaining the European research infrastructures

# Next steps

- Identify and develop relevant “excellent science topics”
  - Promote in and outside of EURAD
  - SRA update
- Contribute to EURAD Road map + SRA update based on
  - Long term vision, scientific excellence, Eurad SRA, RE-SRA JOPRAD , EURAD Roadmap, and Eurad deployment plan
- Promote ideas for 2<sup>nd</sup> wave of EURAD and for EURAD2
  - Most advanced themes
  - Need to discuss with WMOs/TSOs/producers on co-funding
  - Within smaller working groups
  - Interest on largely shared subject

# Next steps (2)

- Knowledge management WPs
  - EuradScience could ask for and propose experts
  - Participate in documenting the state of the art
  - Provide training
  - Prioritisation of knowledge management topics based on analysis of “critical mass” and “loss of knowledge” in certain research themes

# Next steps (3)

- EuradScience could also reflect on how to organize research in Europe (also beyond EURAD)
  - Number of specialists on certain themes go down.
  - Number of dedicated facilities (like hot cells) go down.
  - Coordination of specialist groups working on specific topics.
  - Access to research infrastructure as topic on its own;
    - Should also be paid, but this has never been pursued.
- EuradScience could also play a role in evaluating scientific progress made within EURAD, relative to road map of EURAD and scientific long term vision...

# Future actions for EuradScience (Executive Group to take initiative)

- Definition of the structure
  - legal structure
  - Participant fees
- Provide platform for exchange
  - Project setup
  - Project review
  - Smaller groups collaborations
- Action on infrastructure
- Presentations at conferences or linking with conference organisers
- Linking with other similar organisations including Sitex and IGDTP
- Regular meetings organization (1/y) for future planning
  - Next meeting at the FISA/EURADWASTE conf. the 6/6 2019