ICGR-7 – Empowering Progress in Developing Deep Geological Repositories

Younger Generation Session – Maintaining the Needed Compentences

27 – 31 May, 2024 - Busan, Korea

Virginie Solans, PhD Student EURAD

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This project has received funding from the European Union's Horizon 2020 research and innovation programme 2014-2018 under grant agreement N°847593

Some introductory remarks

- Use of nuclear materials (**nuclear power generation**, **other applications**) **without managing the disused radioactive material** (radioactive waste) **is no option**
- To keep the **nuclear option open**, disposal of all waste must become reality
- **Much progress** has been made – **disposal of L/ILW is 'routine'** in many countries, **disposal of SF/HLW/LL-ILW is becoming reality** in the advanced programmes (Finland, Sweden, France, Switzerland, …) – **capabilities** need to be **maintained** to finish the job
- Independent of the future of nuclear power, disposal will continue for many years – **we need bright people for these projects for the next 100 years and more**
- Although these projects are **very interesting for us insiders** – will we be able to **attract, educate and integrate** a sufficient number of **young and bright people in future**?
- **EURAD** – 'European Joint Programme on Radioactive Waste Management' **works on this** (maintaining **'state-of-the-art'** in our work (RDD, think tank), **transfer of knowledge**, …)

Implementing geological repositories: capabilities are a critical issue

- Repositories for long-lived waste **rely on geology** as part of the multibarrier system
- As **geology** is to some extent **different from one site to the other** ….
- … and **each country having slightly different boundary conditions** (legal, waste inventory, societal needs, etc)
- … **each repository** is to some extent a **'prototype'** and will need **some project-specific work** for its implementation (by implementer, regulator and research entities)
- Thus, **each programme needs key capabilities** (competencies & infrastructure)
- For a broad range of capabilities, a **'market' exists**, but other capabilities are very specific to geological disposal and **no 'market'** is available (**today** and/or in **future** – next ~100 years)
- For these **capabilities**, coordinated **actions may be needed** to ensure their availability
- This applies to **advanced programmes** (transfer of knowledge between generations) and to **early-stage programmes** (transfer of knowledge from advanced to early-stage programmes)

Maintaining the capabilities needed: key elements

- **The persons involved – <u>the human 'capital'</u>:** important issues to make them effective
  - we need **highly qualified people** with **enthusiasm** & **team spirit** → to be able to **understand** the **information**, to acquire **experience** (within a team) & to **apply knowledge** for disposal issues
  - requires **availability & easy access** to **information**: importance of **structure & context**, e.g. provided by a **roadmap** (see EURAD roadmap)
  - ability of **specialists** to also **act as a generalist** to **integrate the information** into the project – needs **experience & broad view** through **involvement in an active programme** for several years
- **What is needed to get there**
  - **attract bright scientists** – disposal projects are **attractive** ('big project', interdisciplinary science & interesting & highly relevant working environment with broad contacts, incl. society)
  - **integrate** new scientists in the **team** (within active project) & **communities of practice**
  - maintain also contacts to **scientific community at large**
  - importance of **international cooperation & joint activities** (e.g. EURAD)

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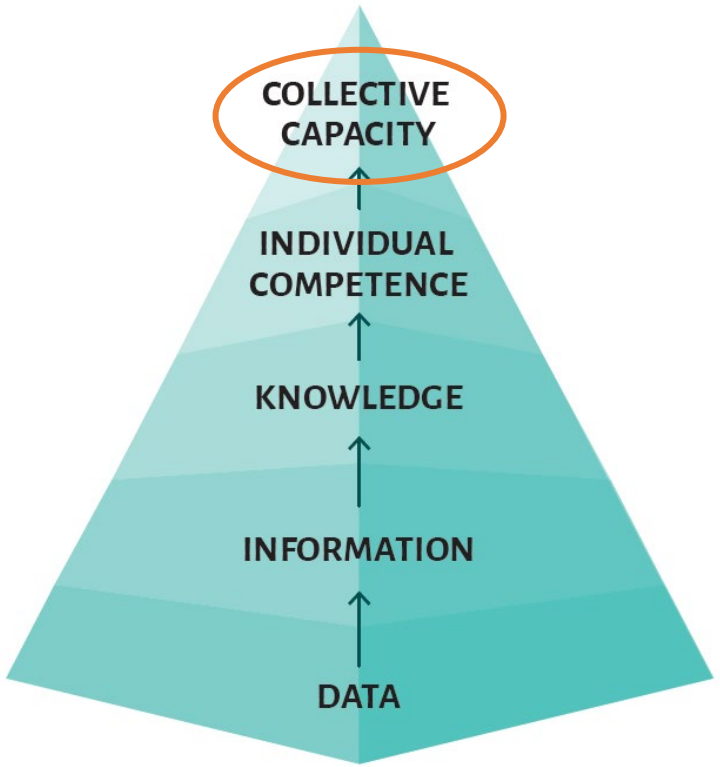


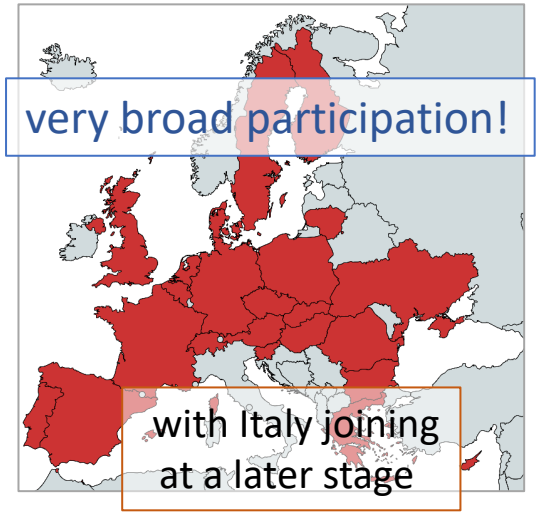
Knowledge pyramid – the ***team*** as path to success

EURAD – European Joint Programme on Radioactive Waste Management

23 European countries (20 Member-States, 3 Associated Countries) with 51 mandated actors cooperate within EURAD:

- Waste Management Organisations (**WMO**)
- Technical Support Organisations (**TSO**)
- Research Entities (**RE**)

… together with 61 linked 3rd parties, 3 international partners & other participants



19 Waste Management Organisations
responsible for implementation

13 regulatory Technical Support Organisations *supporting the regulator*

19 nationally funded Research Entities
working on RWM challenges

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provide added value to member states** in their timely **implementation of radioactive waste management activities

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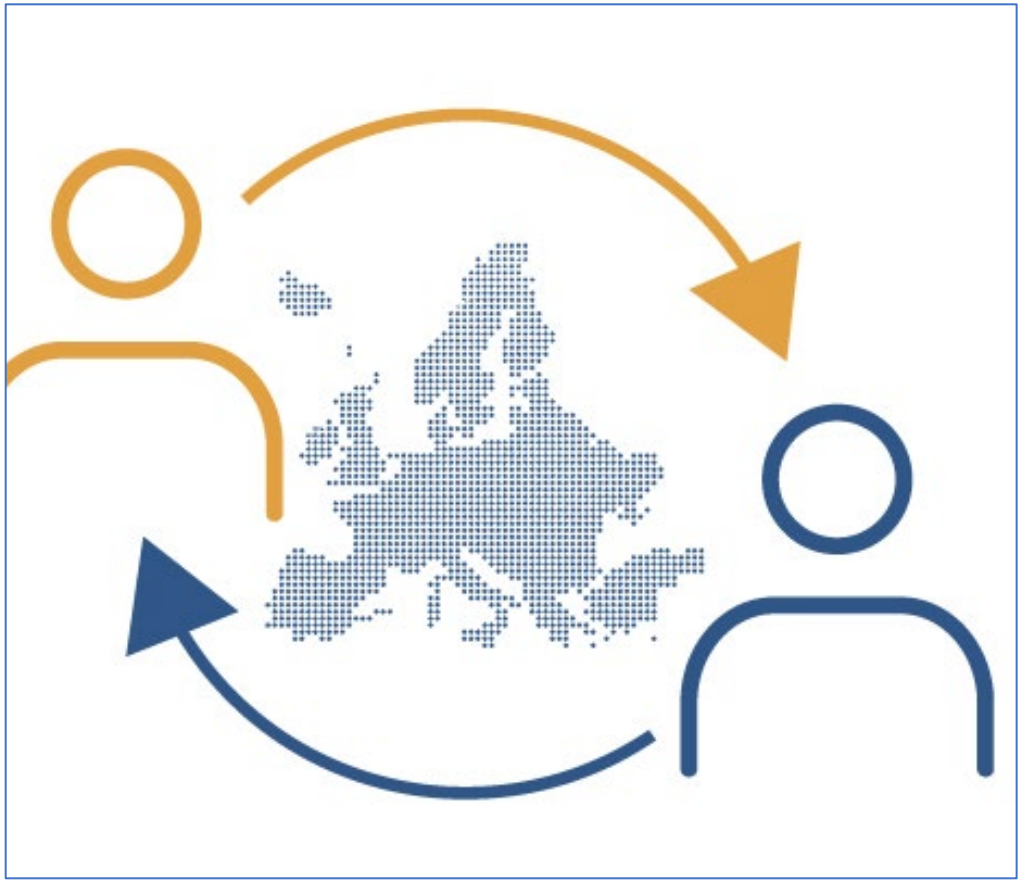
EURAD Objectives – covering a broad spectrum of issues

- Based on *Strategic Research and Knowledge Management Agenda*, perform a cutting-edge **Science and Technology Programme**
- Identify and **elaborate upon complex issues** by bringing together interested actors to jointly conduct **Strategic Studies**
- Support **knowledge transfer** between Member-States and between generations with a strong **Knowledge Management Programme**
- Foster **Mutual Understanding** and **Trust** between Colleges and *Civil Society participants* and other stakeholders



EURAD Knowledge Management & Networking Programme

… provides the 'means' to come up to speed in limited time

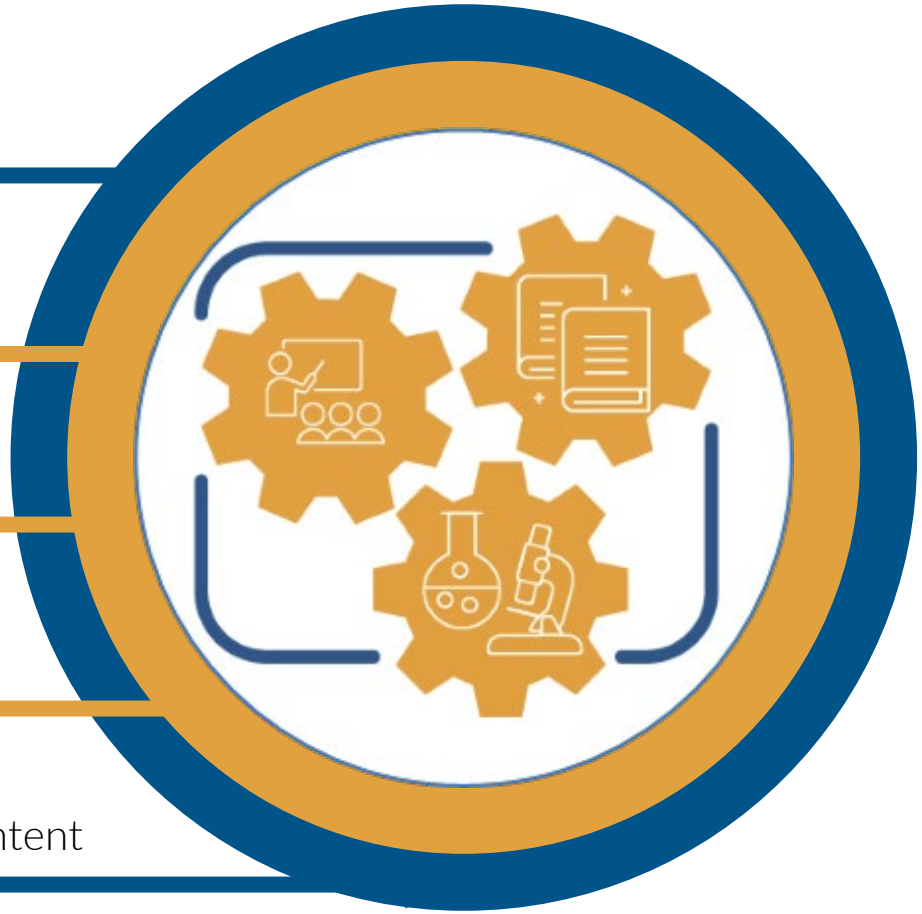
1 **Roadmap**
A common framework to structure knowledge

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

3 **Guidance**
Best practice and lessons learned

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

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



EURAD - creating significant impact: 'discussing', 'informing', 'learning by doing'

'discussing'

370+ presentations

25 lunch-and-learn sessions

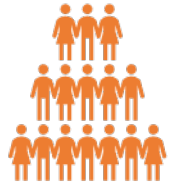
14 civil society events

'informing'

190+ publications

10 State-of-the-Art reports

'learning by doing'



~ 900 individuals

100+ PhD students

~ 110 end-users from 23 countries

EURAD (European Joint Programme on Radioactive Waste Management)

- **EURAD creates cutting-edge science / technology & educates with this highly qualified young persons ('*learning by doing*')**
- **EURAD supports think-tank activities to investigate emerging issues**
- **EURAD engages in preservation and transfer of knowledge**
- **EURAD provides a platform**
  - to ensure an efficient use of resources
  - to cooperate and interact
  - to transfer knowledge through contacts & networking (e.g., communities of practice)
- **… and creates a *stimulating, but demanding working environment* for the young generation – with follow-up positions with implementer, regulator, research**
- **… the implementers, regulators & research institutes need to strengthen their teams now – get in touch to get to know each other to investigate the possibilities**
- **There is a follow-up to EURAD that will help … EURAD-2!**

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… use this conference to learn from each other!

a lot of challenging work has to be done together with you – the younger generation

Thank you for your attention !

https://www.ejp-eurad.eu

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A STUDENT'S VIEW

Virginie SOLANS

PhD student at Uppsala University (EURAD)

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VIRGINIE SOLANS

27 years old

Bachelor in Physics at EPFL in Switzerland (2014-2018)

Where am I going to do my Master's?

- Master in Physics
- Master in Computational Science and Engineering

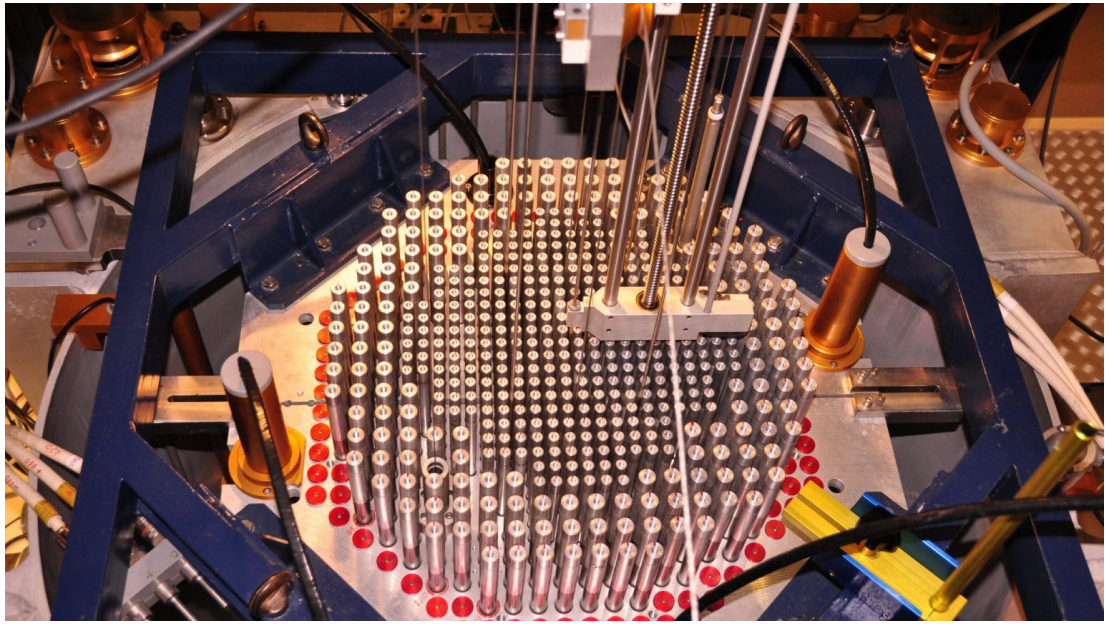
Presentation of the Joint Master's degree in Nuclear Engineering from EPFL/ETH-Zürich.

- Small degree program
- A lot of opportunities (mentors, industrial internship, job)
- Address our fears: political instabilities

MASTER IN NUCLEAR ENGINEERING

- **Possibility to study different areas:**
  - Nuclear for medical applications
  - Nuclear Power Plants
  - Nuclear waste
  - Accident scenarios

- **Different opportunities to explore our interests:**
  - Semester project (Gen IV reactor)
  - Internships (Tokyo University)
  - Master thesis (Nuclear waste)



MASTER THESIS

“Optimization of canister loading using a neural network and genetic algorithm”

- Machine learning
- Nuclear waste

Supervisor: Dimitri Rochman (PSI)

Where should I do my PhD?

SKB is leading the work package on Spent nuclear fuel characterisation of EURAD

PHD AT UPPSALA UNIVERSITY

“Prediction of decay heat using experimental measurements before encapsulation”

At Uppsala University in collaboration with SKB.

Possibility to do a lot of international events (summer schools, EURAD meetings, international conferences, international mobility within EURAD)

- Broader knowledge (context of the work)
- Networking

Next step?

NEXT STEP

Starting at NAGRA this August

- **I can build on my competencies**
- **Added responsibilities**

I even already know my future colleagues!

I will now continue my career in the nuclear waste management industry.

SUMMARY

Step 1: Attract

- Address the young generation's fears
- Transferable skills
- Highlight opportunities

Step 2: Maintain

- Knowledge of the field
- Network
- Job

Thank you for your attention!

APPENDIX

STEP1: ATTRACT

- **Address the young generation's fears:**
  - Political instabilities (fear of a country shutdown). Will I have a job until I retire?
  - Sometimes bad public/family opinion
  - Is there research left to do in the field of NWM? Fundings are for Gen IV, SMRs, …

- **Attract:**
  - Internship, Bachelor & Master thesis
  - Transferable skills
  - Impact in the world

STEP2: MAINTAIN

- **Knowledge (have a broader picture)**
  - Students are focused on solving the problem. Not the context of the work
  - International summer school, International conferences (motivation, funding, snowball effect)

- **Networking**
  - Small community

- **Job Opportunity**
  - Contact from companies, colleagues, working environment
  - Salaries