NEA Activities in the area of Radioactive Waste Management

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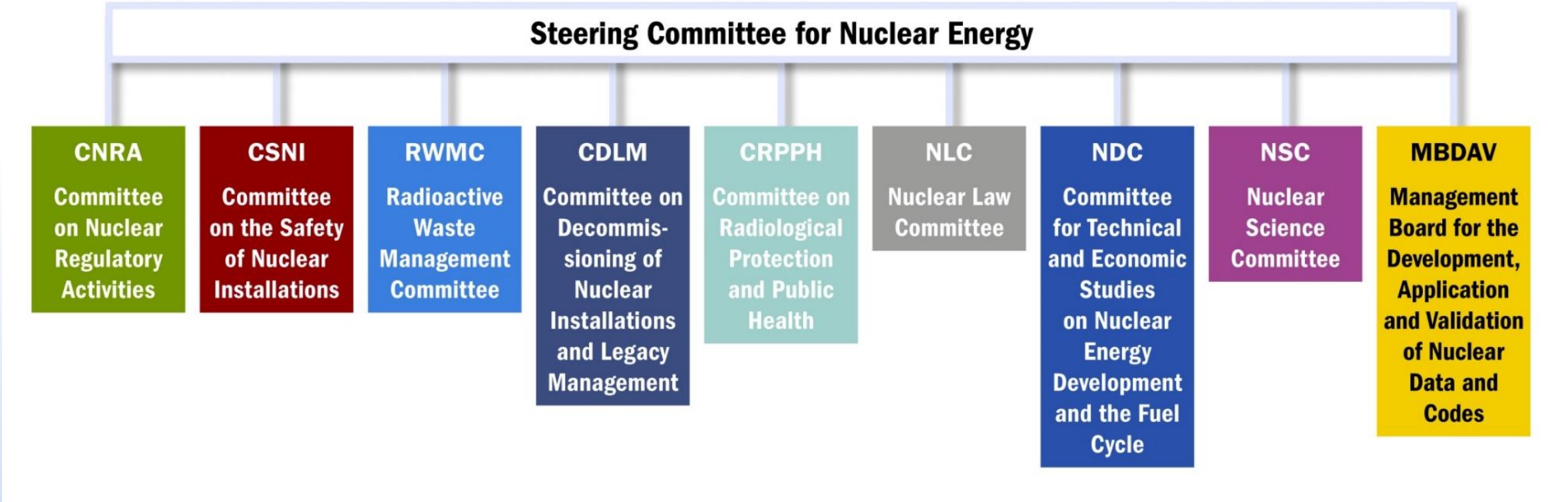
The NEA: 34 Countries Seeking Excellence in Nuclear Safety, Technology, and Policy

- 34 member countries + strategic partners (e.g., China and India)
- 8 standing committees and more than 80 working parties and expert groups
- 23 International joint research projects
- Expanding global relationships with industry and universities.

NEA countries operate about 86% of the world's installed nuclear capacity

NEA Standing Technical Committees



The NEA's committees bring together top governmental officials and technical specialists from NEA member countries and strategic partners to solve difficult problems, establish best practices and to promote international collaboration.

Radioactive Waste Management

With 449 nuclear power reactors in operation, 53 under construction, and thousands of radioactive sources being used worldwide, radioactive waste management requires the attention of national decision makers.

As of 2013	L&ILW [m^3]	HLW [m^3]	NPP Spent Fuel [t HM]
Global total	4,000,000	22,000	368,000
NEA countries	2,600,000	17,000	344,000

Source: IAEA Status & Trends Report 2018


Nuclear medicine


Fuel fabrication


Nuclear power production


Fuel reprocessing

NORM


Research

Management of LLW

- Low radioactivity that does not require shielding during handling and transport.
- LLW comprises ~90% of RW volume but only 1% of the radioactivity of all RW.
- Often volume reduced via incineration, compaction.
- Interim above-ground storage (> 50 years)
- Suitable for shallow land burial or near surface disposal facilities.

This LLW disposal site accepts waste from States participating in a regional disposal agreement.

Management of ILW

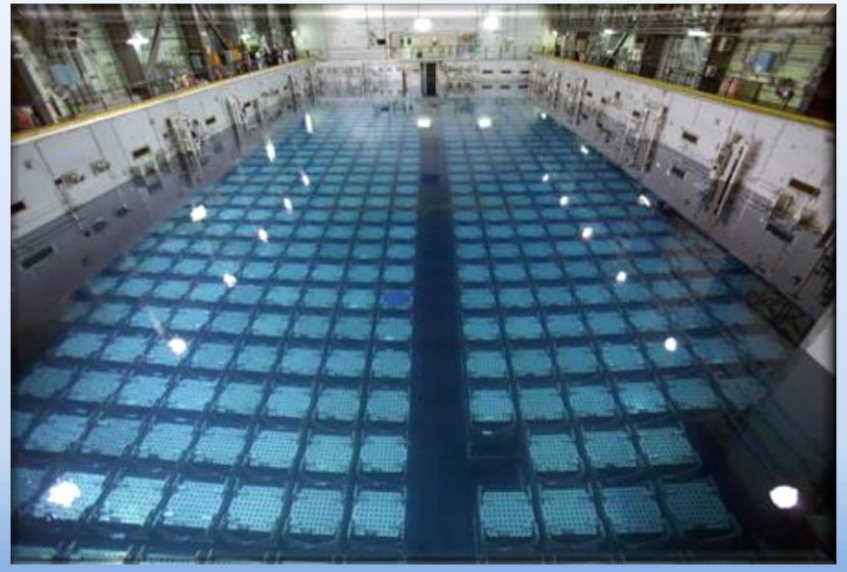
- Requires shielding during handling and transport (e.g. resins, chemical sludge, metal fuel cladding).
- Non-solids can be solidified in concrete or bitumen to immobilize radionuclides.
- Interim near-surface storage, i.e. above-ground, or 10s of metres below ground, typically for > 50 yrs.
- Most countries are planning to dispose of ILW in geological repositories.
- Some countries, in specific cases, are considering the disposal of limited amounts ILW in near-surface facilities – safety must be addressed in the safety case for the disposal facility.

ILW packed in cemented steel drum

Waste Isolation Pilot Plant WIPP, USA

Dealing with Nuclear Waste:
Strategies and Considerations

- **On-site storage**—HLW can be maintained in pools and dry casks for many years**.**
- **Interim Storage—**HLW can be stored for decades and in some concepts in the order of 100 years**.**
- **Conventional Reprocessing—**in use today in France and other countries.
- **Advanced Recycling—**under development in several countries
- **Deep Geologic Repositories—**required even if reprocessing is applied.



Nuclear Waste Inventory (IAEA estimates, 2018)

The IAEA estimates that over 80% of all LLW and VLLW produced to date is in disposal. For ILW, the IAEA estimates that about 20% is in disposal, with the balance in storage.

	Solid radioactive waste in storage (m^3)	Solid radioactive waste in disposal (m^3)	Proportion of waste type in disposal
Very Low Level Waste	2,356,000	7,906,000	77%
Low Level Waste	3,479,000	20,451,000	85%
Intermediate Level Waste	460,000	107,000	19%
High Level Waste	22,000	0	0%

Near-Surface Disposal Facilities Currently in Operation

- UK – LLW Repository at Drigg in Cumbria operated UK Nuclear Waste Management.
- Spain – El Cabril LLW and ILW disposal facility operated by ENRESA.
- France – Centre de l'Aube and Morvilliers operated by ANDRA.
- Sweden – SFR at Forsmark operated by SKB.
- Finland – Olkiluoto and Loviisa, operated by TVO and Fortum.
- Russia – Ozersk, Tomsk, Novouralsk, Sosnovy Bor, operated by NO RAO.
- South Korea – Wolseong, operated by KORAD.
- Japan – LLW Disposal Center at Rokkasho-Mura operated by Japan Nuclear Fuel Limited.
- USA – five LLW disposal facilities: operated by Waste Control Specialists; Energy Solutions; and American Ecology Corporation.

Key Principles and Stages of Efficient Waste Management Processes

- Stakeholders' engagement to define end stages and associated strategies;
- Characterization and inventories;
- Material classification, acceptance criteria for waste disposal, and establishment of clearly defined waste routes;
- Treatment and optimization techniques;
- Economics and financial planning (e.g. managing uncertainties and unexpected challenges during dismantling.

Radioactive Waste Management Trends

- A sustainable solution comprises 3 constituents:
  - **Environment**
  - **Economy (optimisation)**
  - **Society**
- Stakeholder engagement is essential in RWM (required by laws). Many RWMOs are evolving from focusing on technical matters to learning societal requirements.
- Good practice to assist public stakeholders to develop their competence for making sound and informed decisions.

What's the Issue

Difficulties in achieving public support due to

- Scientific analyses may not address the concerns of public or their perceptions of risk
- Competing and conflicting values among different stakeholders
- Low public trust in radioactive waste organizations

Who is working on it?

- NEA has **established the concept of the safety case**
- Safety case development established as **structured process** for integrating science, engineering, safety assessment, quality assurance – using well-defined strategies to build confidence in decision-making
- Important progress in **tools & concepts for integration**
- Greater stakeholder involvement during Siting and Licensing stages – current focus on **safety case communication** and collaboration with Forum for Stakeholder Confidence (FSC)

Who is working on it cont.?

- NEA Technical Committees are working on:
  - Key features & activities in safety case development
    - Integration
    - Safety functions
    - Handling uncertainty
    - Scenario development
    - Knowledge management
  - Regulatory perspective
  - Safety case communication & stakeholder interaction
  - Main messages & outlook

Link

An Example of a Beneficial International Effort: *NEA Forum on Stakeholder Confidence (FSC)*

- Established in 2000 to analyse and support stakeholder interaction and public participation in decision-making
- 10 "national workshops" conducted thus far – most recently in Berne, Switzerland
- Issued Publications such as "*Stakeholder Involvement in Decision Making: A Short Guide to Issues, Approaches and Resources*"
- Main Principles:
  - Transparency of the process
  - Stepwise decision making and reversibility
  - Partnership approach between all Stakeholders

2012 Country Workshop, Czech Republic

2016 Country Workshop, Switzerland

Conclusion

- LLW radioactive waste Disposal is a proven technology that is used around the world.
- Specially designed interim surface or sub-surface storage waste facilities are currently used in many countries to ensure the safe storage of hazardous radioactive waste pending the availability of a long-term disposal option.
- A stepwise, adaptive and fully transparent decision-making process that involves key stakeholders, including implementers, regulators and the general public is effective.
- Stakeholders' trust and confidence in the local project increase when they can see that other countries are approaching the solution to HLW and SNF disposal in the same way as the local project.
- Involving younger generation stakeholders in the decision-making processes is not only imperative, as they will inherit the project in the future, but also effective.
- International collaboration on technical aspects, utilising facilities and research in other countries, is a cost-effective way to further strengthen the technical understanding for radioactive waste disposal programmes.

Thank you for your attention

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