Decommissioning in the NEA: Four Decades of Achievements and Future Directions

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Decommissioning Meeting
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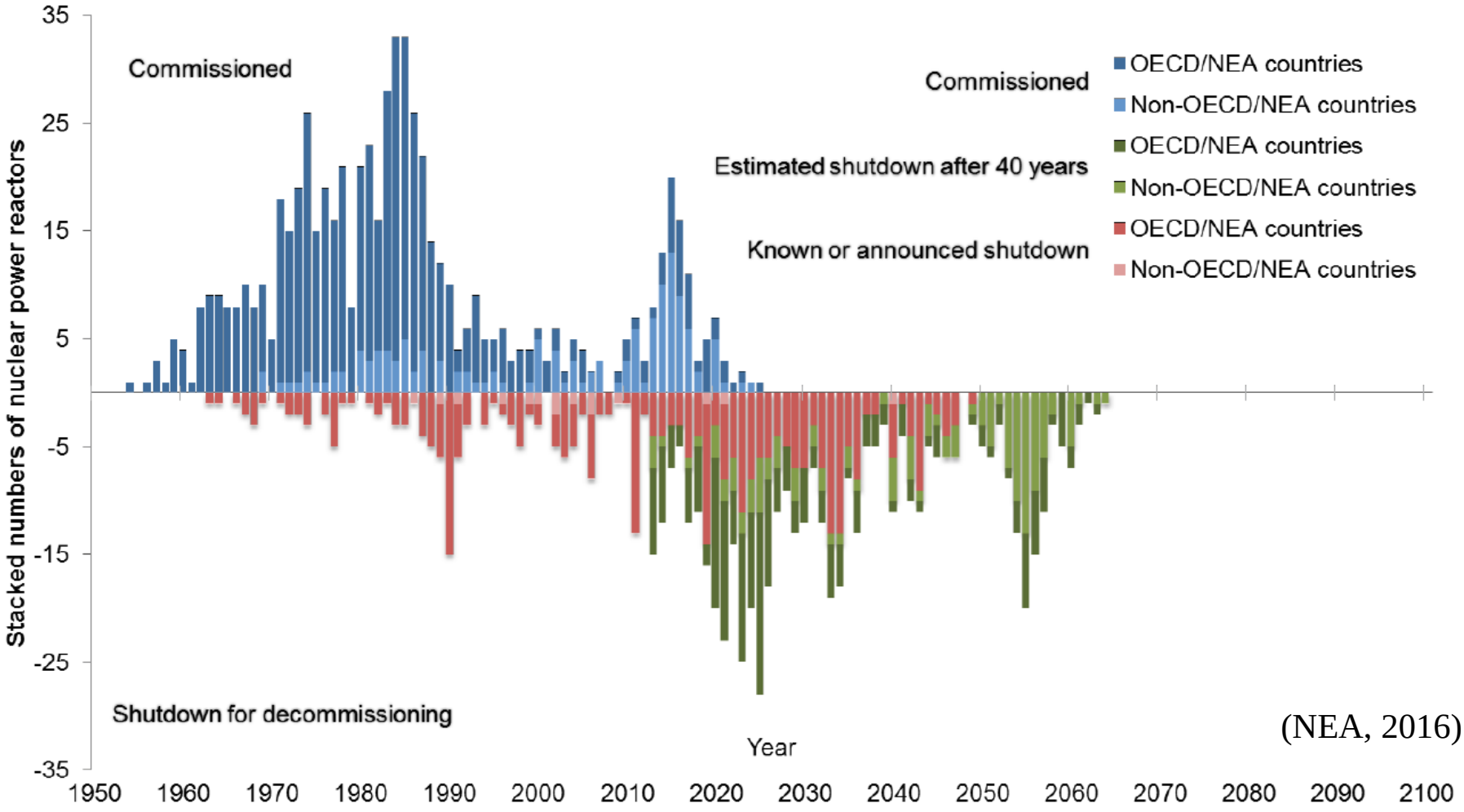
Outline

- Global Nuclear Decommissioning Trends
- Key Milestones in the NEA
- Achievements in 1978-2018
- Challenges and Future Directions

Global Nuclear Decommissioning Trends



(NEA, 2016)

The NEA mission

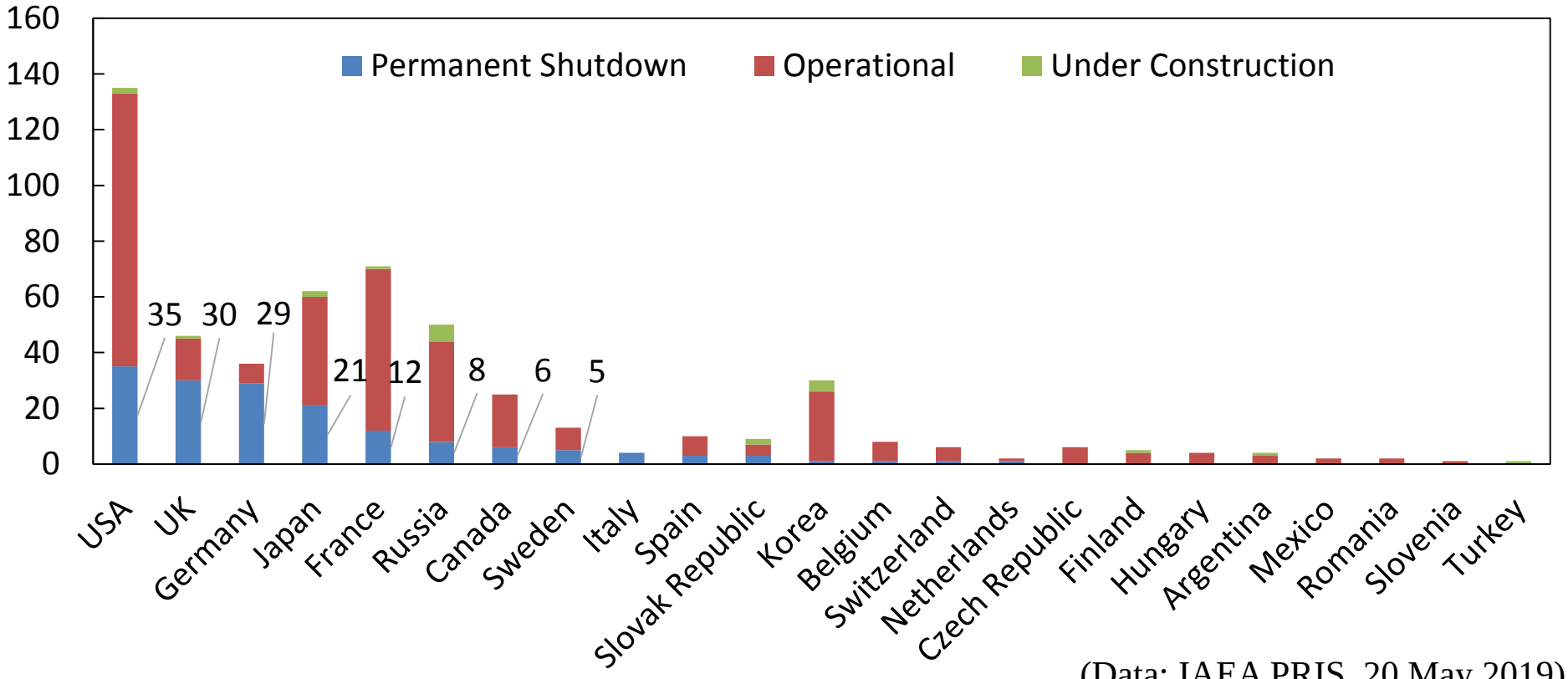
- To assist its member countries in maintaining and further developing, through **international co-operation, the scientific, technological and legal bases** required for a safe, environmentally sound and economical use of nuclear energy for peaceful purposes.

- To provide authoritative assessments and to forge **common understandings** on key issues as **input to government decisions on nuclear energy policy** and to broader OECD policy analyses in areas such as energy and the sustainable development of low-carbon economies.

*The NEA's current membership consists of **33 countries** in Europe, the Americas and the Asia-Pacific region.*
*Together they account for approximately **84%** of the world's installed nuclear capacity.*

Nuclear Power Reactors in NEA Member Countries

- 161 reactors are in the shutdown mode
- 372 reactors will be shut down in the future



(Data: IAEA PRIS, 20 May 2019)

Key Milestones in the NEA

1978

First decommissioning programme in the NEA

1985

NEA Co-operative Programme for the Exchange of Scientific and Technical Information Concerning Nuclear Installation Decommissioning Projects (CPD)

2001

Working Party on Decommissioning and Dismantling (WPDD)

2018

Committee on Decommissioning of Nuclear Installations and Legacy Management (CDLM)

CPD

- The NEA Co-operative Programme for the Exchange of Scientific and Technical Information Concerning Nuclear Installation Decommissioning Projects (CPD)
  - Established in 1985
  - Governance with CPD Management Board meeting once a year in Paris and Technical Advisory Group (TAG) meeting on sites, twice a year.
  - Focused on technical aspects, based on actual hands-on/off decommissioning experience
- 52 “active” projects from 26 organisations
  - 28 NPP’s and Research Reactors
  - 24 Fuel Cycle Facilities

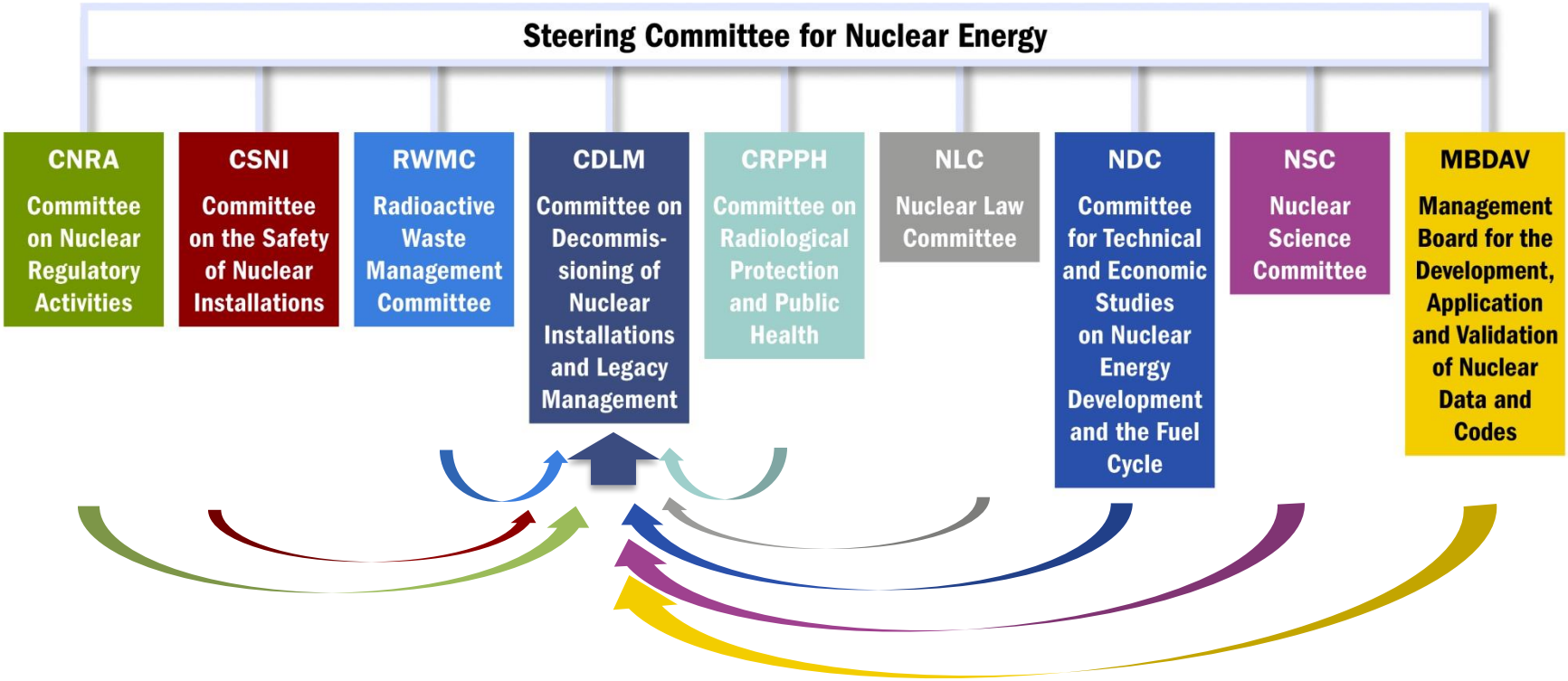
Committee on Decommissioning of Nuclear Installations and Legacy Management (CDLM)

- **Membership**
  - Representatives from regulatory authorities, policy-making bodies, decommissioning implementers, research institutes and other interested stakeholders.
  - Received 71 nominations, from 20 countries and the EC.
  - IAEA as observer.

Australia	Finland	Japan	Russia	Sweden
Belgium	Germany	Korea	Slovakia	Switzerland
Canada	Hungary	Netherlands	Slovenia	UK
France	Italy	Norway	Spain	USA

Webpage: www.oecd-nea.org/rwm/cdlm/

NEA Standing Technical Committees



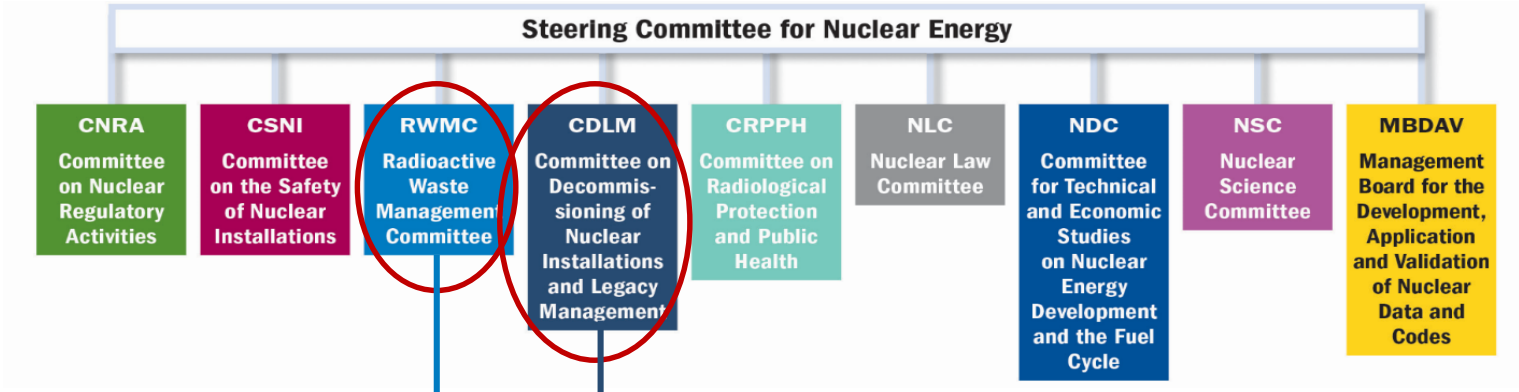
The NEA's committees bring together top governmental officials and technical specialists from NEA member countries and strategic partners to solve difficult problems, establish best practices and to promote international collaboration.

Achievements in 1978-2018

- Country profiles and reports
- Best practices
- Peer review & expert feedback
- Global platforms
  (CPD, WPDD, CDLM)

Webpage: www.oecd-nea.org/rwm/profiles/

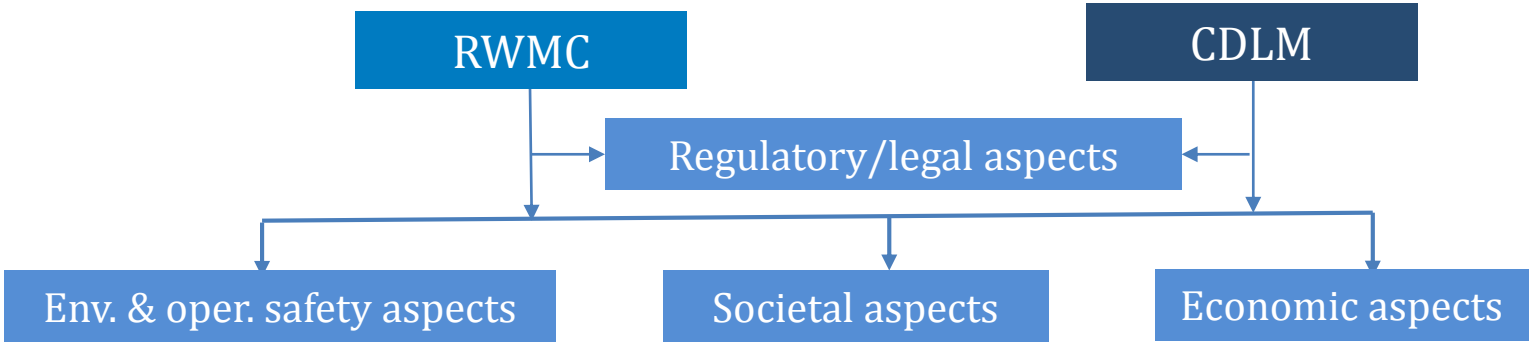
Holistic Approach



Objectives

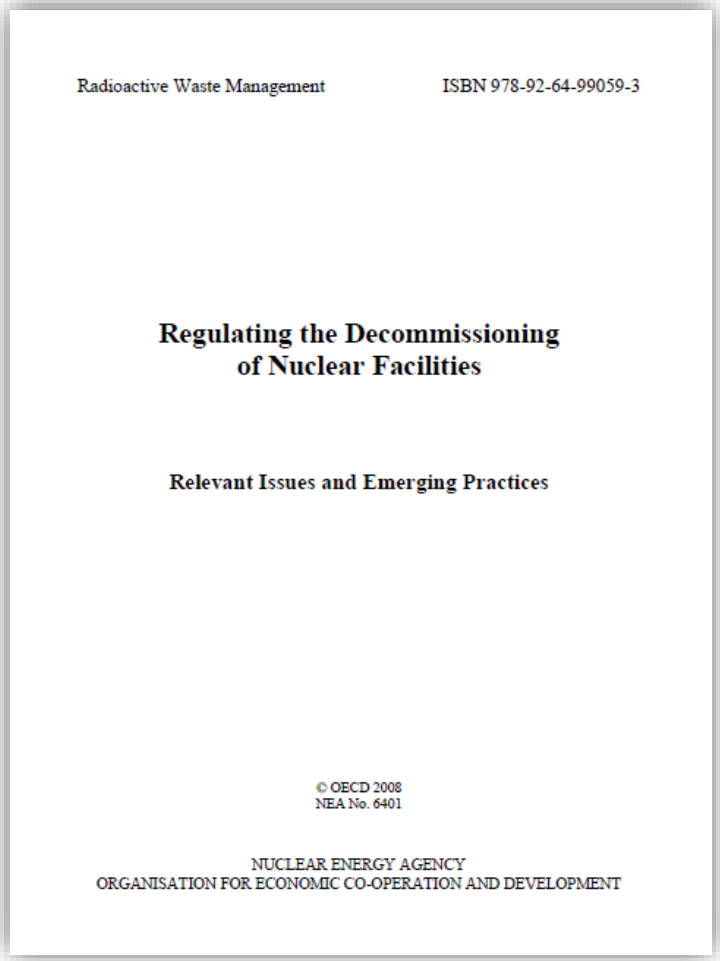
Define strategic policies, best practices in addressing safety, societal and economics issues in managing RW in all phases.

Define strategic policies, best practices in nuclear decommissioning and legacy management.



Best Practices in Regulatory Aspects

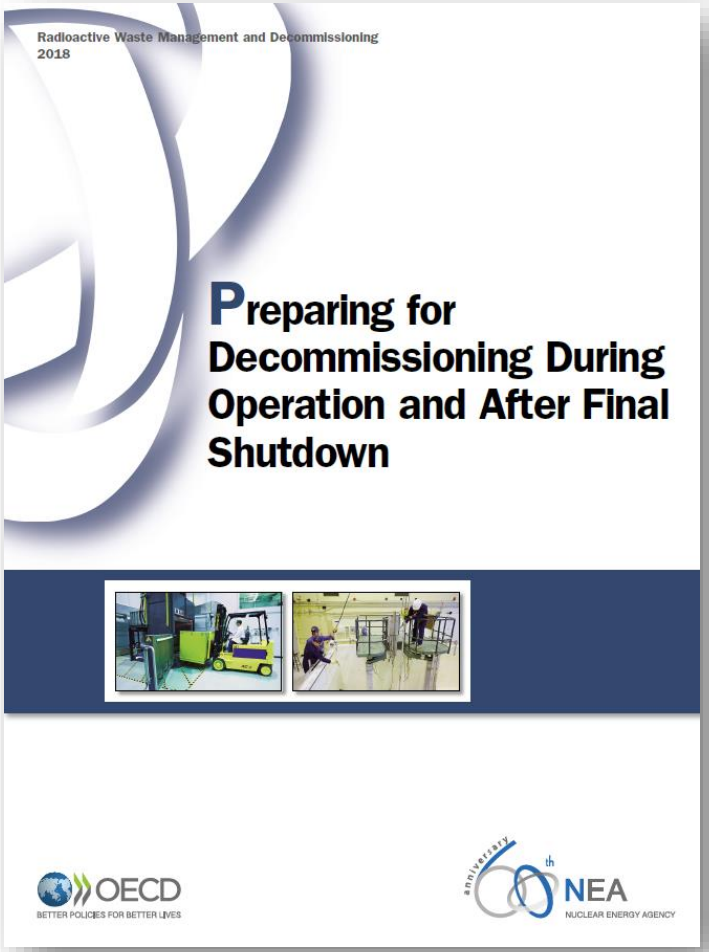
- **Recommendations**
  - An **early and open dialogue** between regulators and implementers and other stakeholders (the public, etc.)
  - A **stepwise (phased) approach** in licensing decommissioning activities
  - Clear **definitions** of transition period, clearance and end state
  - **Flexibility and harmonisation** of regulations (waste classification)
  - Proportionate regulation for **changing risk profiles**



(NEA WPDD&RF, 2008)

Best Practices in Environmental Aspects

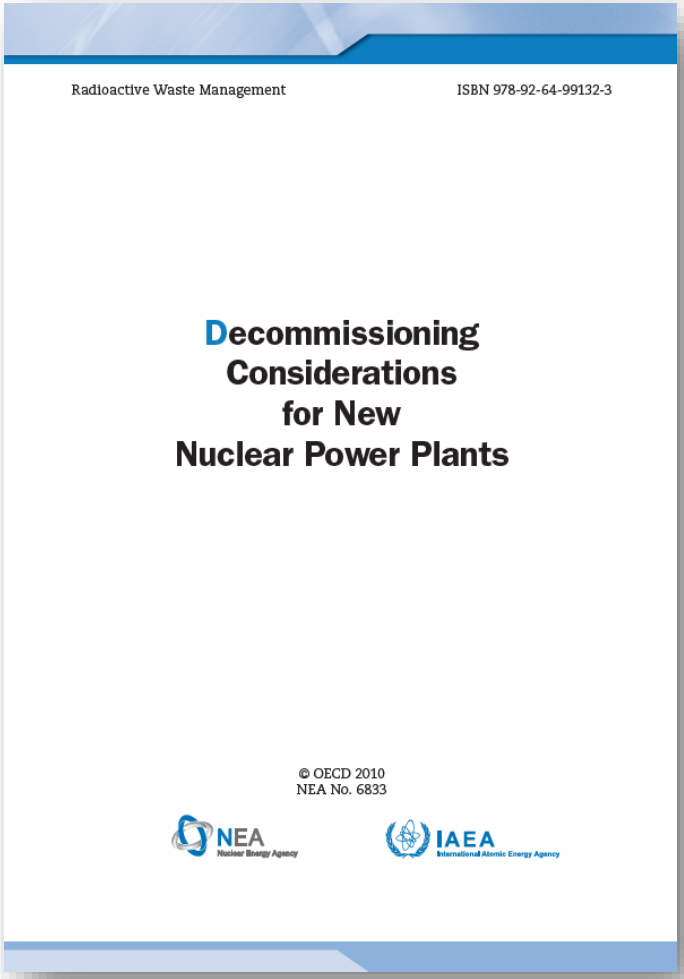
- **Before decommissioning**
  - **Preparing** for decommissioning during operation and after final shutdown (2018)
  - Applying decommissioning experience to the design and operation of **new** plants (2010)
- **During decommissioning**
  - **Recycling and reuse** of materials airing from the decommissioning of nuclear facilities (2017)
  - **Remote handling techniques** in decommissioning (2014)
  - Achieving the goals of the decommissioning **safety case** (2005)



(NEA WPDD, 2018)

Design of New NPPs - 1

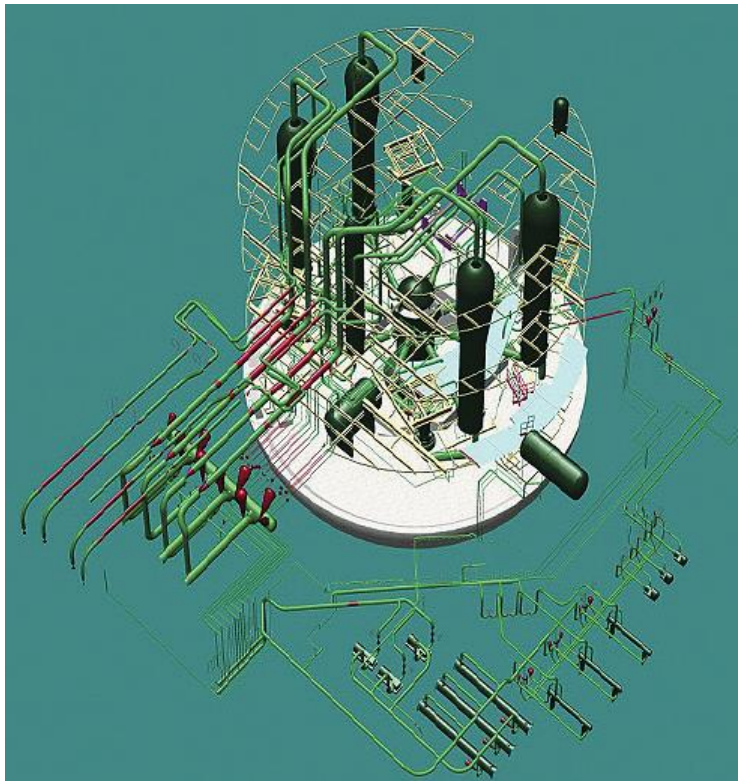
- **Design features to facilitate decommissioning**
  - Decommissioning plans
  - Site factors
  - Facilities and systems design
  - Structural design
  - Operational design
  - Materials design and waste management



(NEA & IAEA, 2010)

Design of New NPPs - 2

- **Some best practices**
  - Submit the entire plant to a structured review from the perspective of decommissioning
  - Simplify dismantling and equipment handling
  - Minimise the use of embedded or underground piping
  - Make use of 3-D models for plant configuration management
  - Develop design requirements for waste minimisation and component removal
  - Make decommissioning experience available to reactor designers

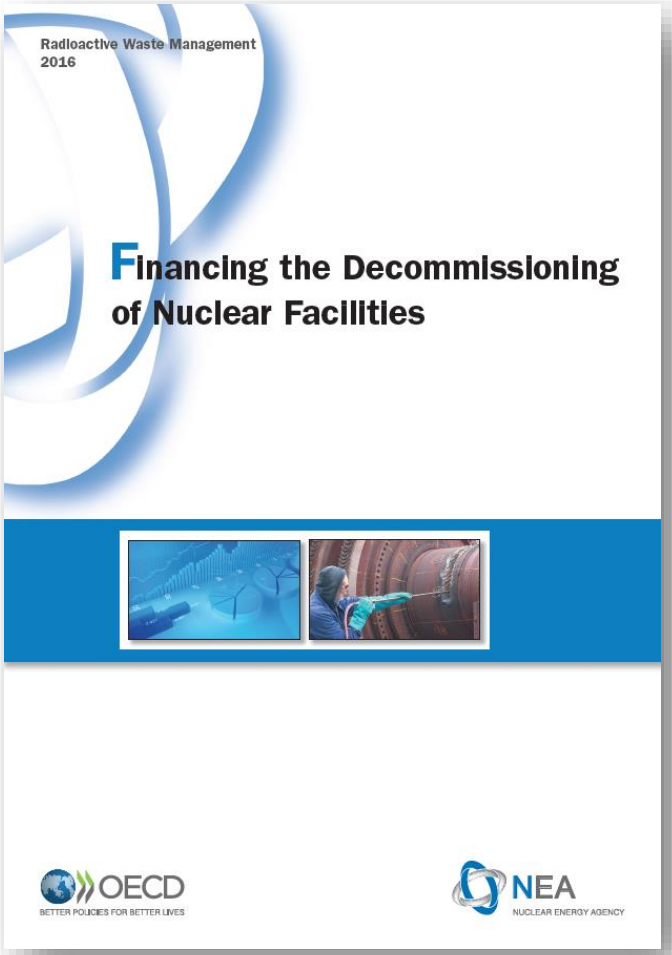


(Photo courtesy: SOGIN)

(NEA & IAEA, 2010)

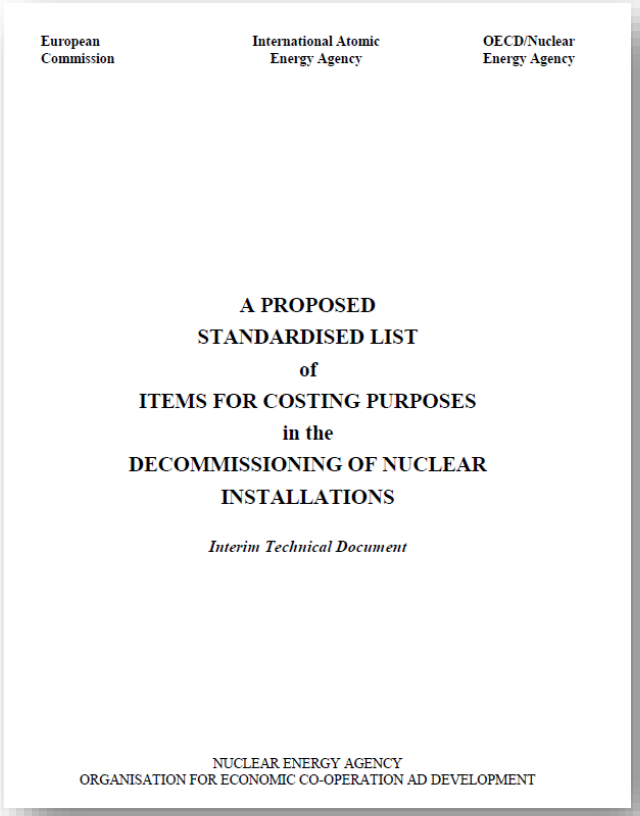
Best Practices in Economic Aspects

- **Funding**
  - **Financing** the decommissioning of nuclear facilities (2016)
  - Decommissioning **funding**: ethics, implementation, uncertainties (2006)
- **Cost estimation**
  - Addressing **uncertainties** in cost estimates for decommissioning nuclear facilities (2017)
  - **Costs** of decommissioning nuclear power plants (2016)
  - **Cost control guide** for decommissioning of nuclear installations (2013)



(NEA WPDD, 2016)

International Structure for Decommissioning Costing (ISDC)


European Commission
International Atomic Energy Agency
OECD/Nuclear Energy Agency

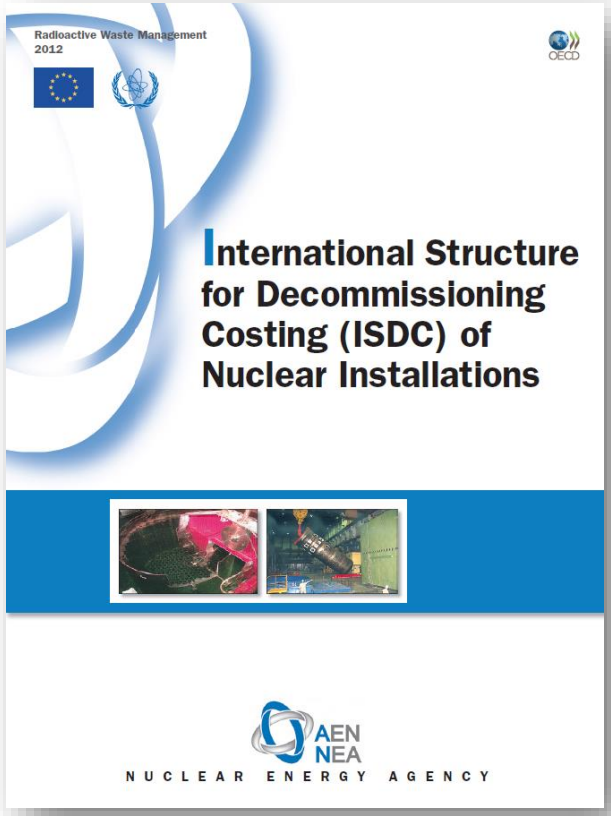
A PROPOSED
STANDARDISED LIST
of
ITEMS FOR COSTING PURPOSES
in the
DECOMMISSIONING OF NUCLEAR
INSTALLATIONS

Interim Technical Document

NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AD DEVELOPMENT

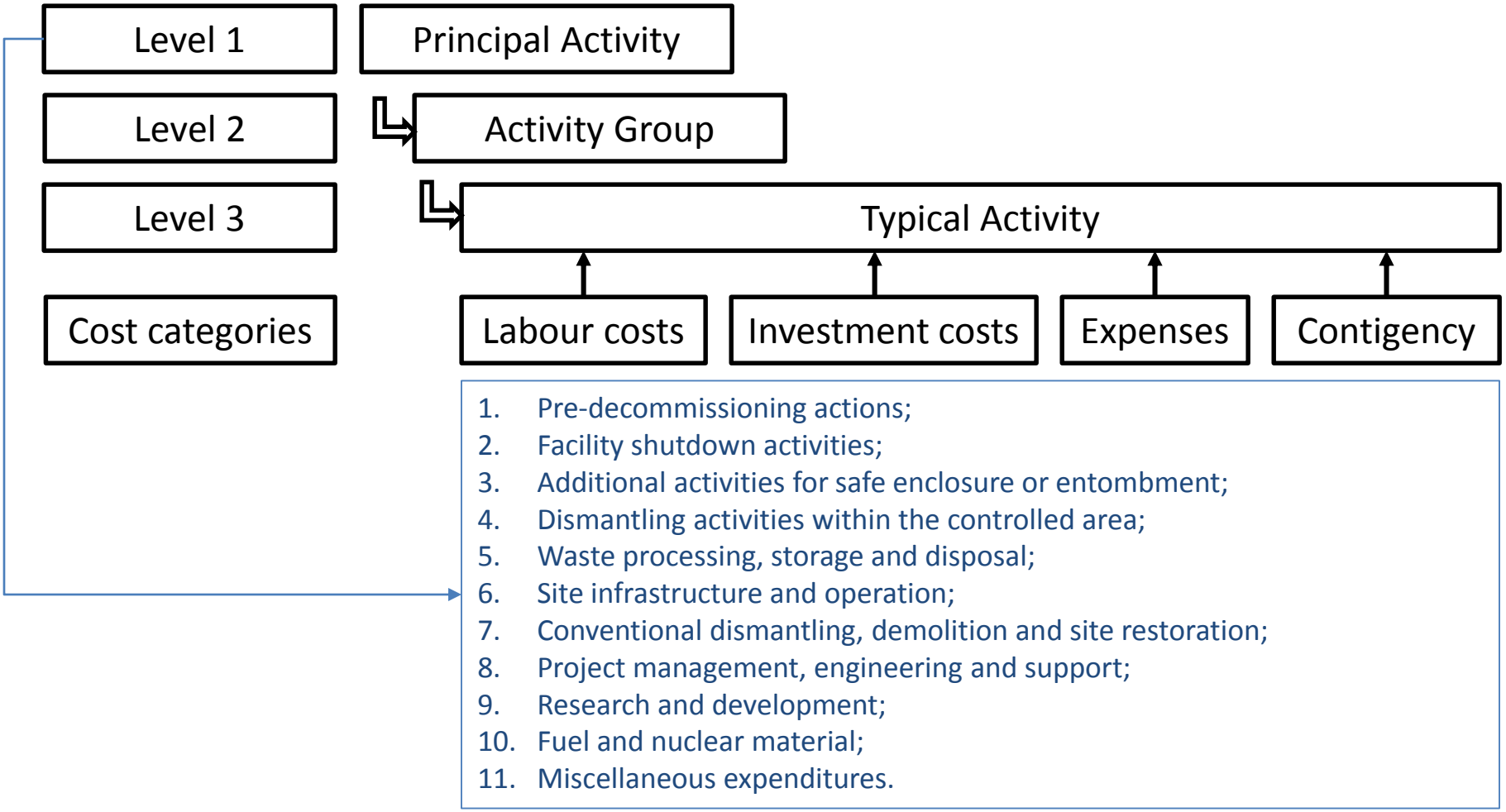
(NEA, IAEA and EC, 1999)

Application in some countries



(NEA, IAEA and EC, 2012)

International Structure for Decommissioning Costing (ISDC)

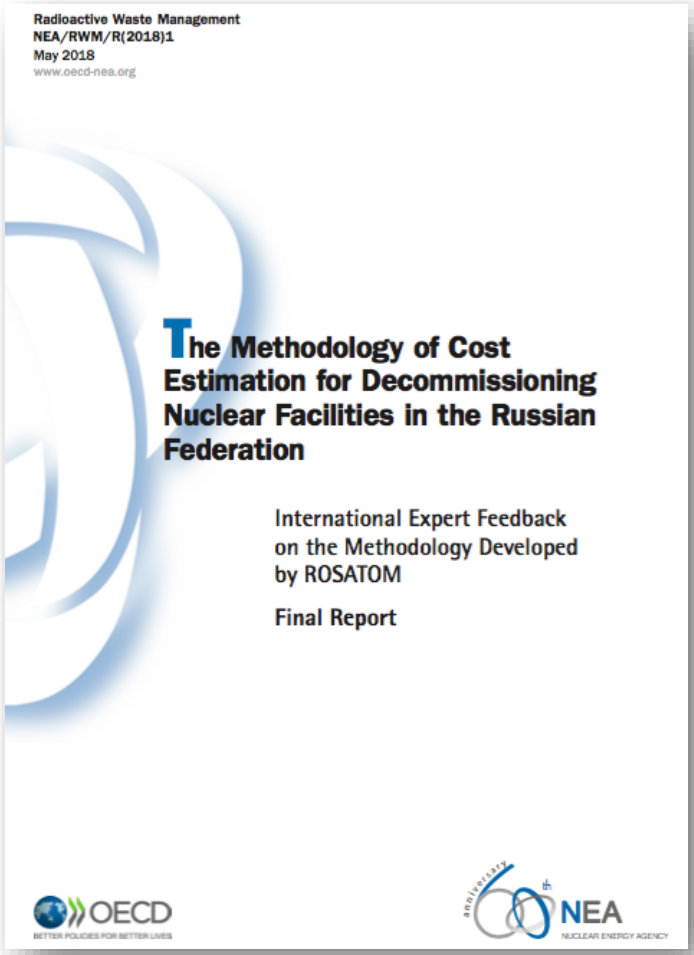


(NEA, IAEA & EC, 2012)

Peer Review and Expert Feedback

- **Peer review**
  - **Guide** for International Peer Reviews of Decommissioning **Cost** Studies for Nuclear Facilities (2014)
- **Expert feedback**
  - Review the **ROSATOM Decommissioning Cost Estimation Methodology** and its application based on international guidelines, on international good practices (including the ISDC) and on strategies of other national programmes.

Webpage: www.oecd-nea.org/rwm/peer.html



(NEA WPDD, 2018)

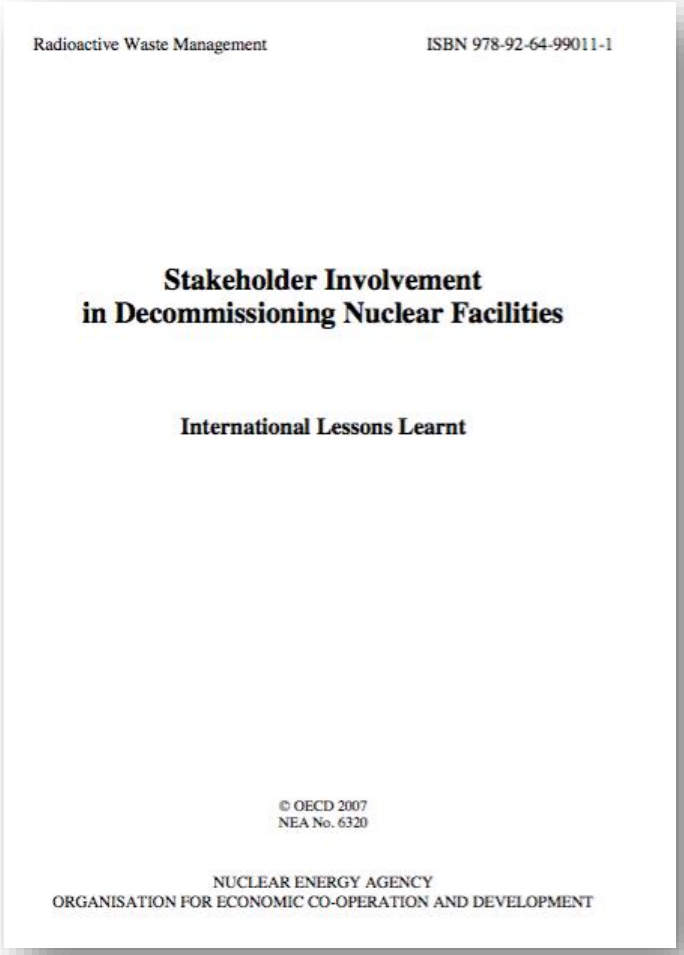
Best Practices in Societal Aspects - 1

Stakeholders' Map

(NEA WPDD, 2018)

Best Practices in Societal Aspects - 2

- **The national dimension**
  - Link to national energy policy
  - Link to the national radioactive waste management policy
- **The local dimension**
  - The need for early involvement and cooperation
  - Maintaining stability
  - **Local interest in site re-use and redevelopment**
  - Trust building
  - Sustainability and foresight



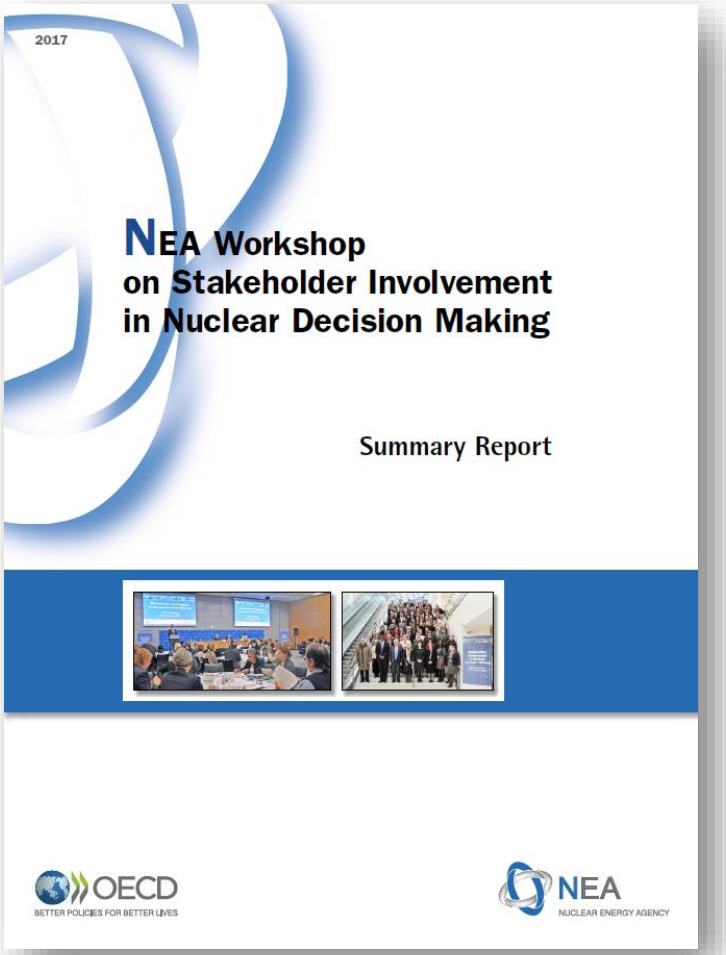
(NEA WPDD, CPD and FSC, 2007)

Best Practices in Societal Aspects - 3

- **Recommendations**
  - The **process for stakeholder involvement** should be well developed and transparent. **"The rules of the game"** should be clear and agreed upon among parties involved.
  - Dialogue and co-operation among regulators, implementers, and local stakeholders should be developed **as early as practicable**.
  - Stakeholders should be informed of the health and other implications of **different management options** and **steps to achieve end-state**.
  - There is also a need to **retain a certain flexibility**, in order that local considerations can be adequately accommodated.

NEA Workshop on Stakeholder Involvement

- **Recommendations**
  - As a major lesson, **face-to-face interaction** and effective listening are very important.
  - It is wise to take into account and respect **local knowledge**. Local people may be recruited who are experts in their own places and traditions and who can talk directly with the public concerned.
  - Education and training today must prepare **youth** to take over the responsibilities related to the future management of all aspects of nuclear power.



(NEA, 2017)

Recent Topical Sessions in the WPDD

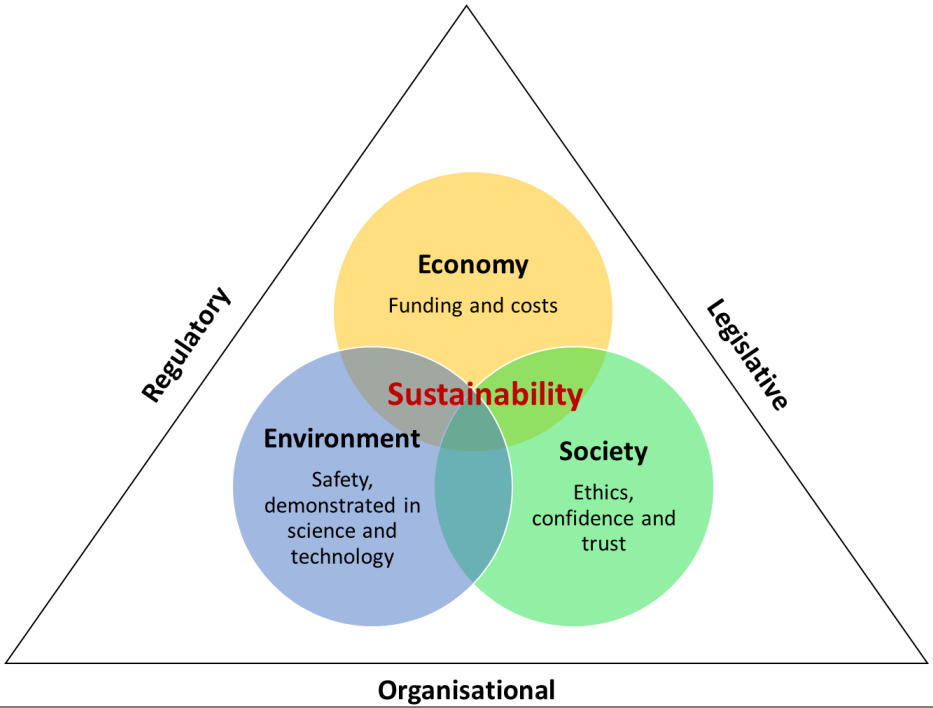
Year	Topical Session
2010	R&D needs for decommissioning
2011	Radiological characterization and decommissioning
2012	Nuclear site restoration
2013	Preparation for decommissioning during operation and after final shutdown
2014	Optimising management of low activity radioactive waste and materials from decommissioning
2015	Extended and deferred decommissioning
2016	Regulation of decommissioning
2017	Decommissioning and society - social aspects of decommissioning
2018	Summary of WPDD major achievements and the WPDD questionnaire

Recent Topical Sessions in the CPD

Year	Meeting	Topical Session
May 2016	TAG 60	Managing the issues arising from moving from operation to decommissioning
Oct 2016	TAG 61	Decommissioning issues arising during dismantling and waste management of material contaminated by hazardous materials
May 2017	TAG 62	Site remediation issues to consider in planning and execution of a nuclear decommissioning project
Oct 2017	TAG 63	Decommissioning material management as main issue of a smoothly running decommissioning project
May 2018	TAG 64	Use of intervention suits in combination with asbestos and other hazardous or special materials
Oct 2018	TAG 65	Different used cutting tools for dismantling, like plasma cutting, laser cutting, …

Challenges and Future Directions - 1

- **Holistic approach and systematic optimisation**
  - Optimisation of environmental, societal and economic factors
  - Holistic considerations from design to decommissioning
  - Safety from both a radiological and conventional risk perspective
- **Upcoming event**
  - The Multifactor Optimisation of Predisposal Management of Radioactive Waste,10 - 13 February 2020, Boulogne-Billancourt, France



Challenges and Future Directions - 2

- **Regulatory challenges**
  - Gaining and maintaining knowledge and expertise
  - Regulations on transition phase, clearance, and end state
  - Developing the decisional process (a stepwise approach)
  - Flexibility and harmonisation of regulations (waste classification)

- **Ongoing and upcoming NEA activities**
  - Regulators' Forum (RF)
  - RF workshop on the competency management of regulators
  - A questionnaire on regulation of Very Low Level Waste will be distributed to member countries.

Challenges and Future Directions - 3

- **Environmental and operational safety challenges**
  - Development and application of remote and robotic systems
  - Characterisation, classification and minimisation of waste
  - Training and development of staff
- **Ongoing and upcoming NEA activities**
  - The NEA Co-operative Programme for the Exchange of Scientific and Technical Information on Nuclear Installation Decommissioning Projects (CPD)
  - NEW – Initiative on Application of Remote and Robotic Systems in Nuclear Back-end Activities (RRS)
  - NEW – Working Party on Information, Data and Knowledge Management (IDKM)
  - NEW – NEA Nuclear Education, Skills and Technology (NEST) Framework

NEA Nuclear Education, Skills and Technology (NEST) Framework

- **Purpose**
  - In February 2019, the NEA launched the NEST Framework in partnership with 10 of its member countries and 15 organisations to help address important gaps in nuclear skills capacity building, knowledge transfer and technical innovation in an international context.
- **The initial NEST projects include**
  - Russia: Decommissioning of graphite production reactors in Seversk
  - Japan: Robotics in support of decommissioning

Challenges and Future Directions - 4

- **Economic challenges**
  - Benchmarking in the context of decommissioning costs (i.e. NPPs, RRs, other facilities)
  - The management of uncertainties in cost estimation
  - The cost-effective management of projects and ways of cost optimisation
  - Ensuring adequacy of funding arrangements for decommissioning

- **Ongoing and upcoming NEA activities**
  - Ad hoc meeting of costing experts on decommissioning and legacy management for CDLM, 9-11 September 2019, Boulogne-Billancourt, France

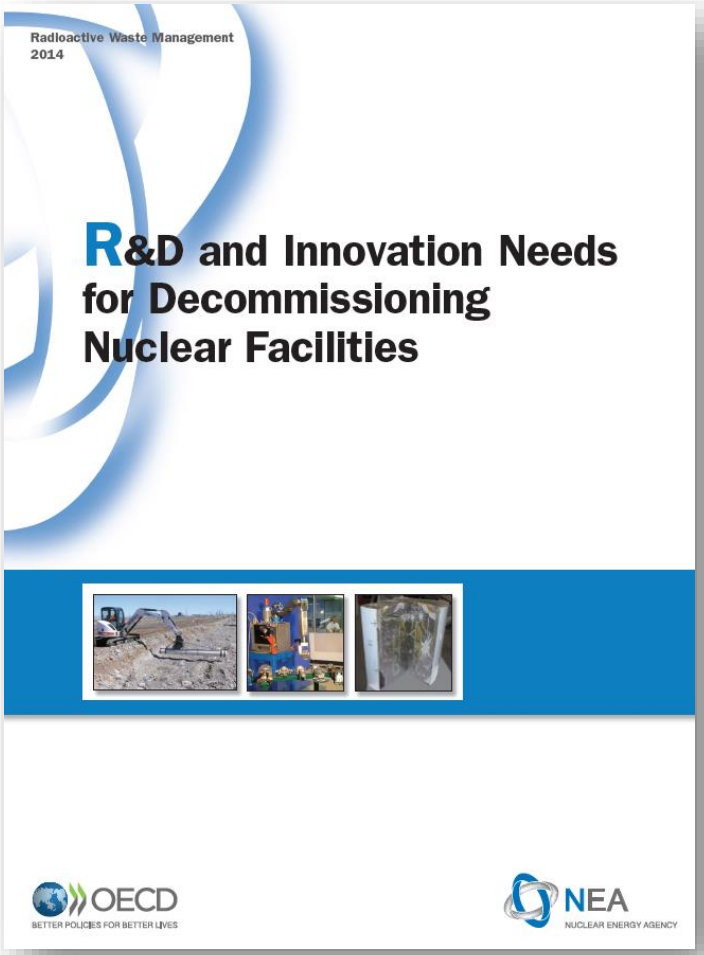
Challenges and Future Directions - 5

- **Societal challenges**
  - The process of stakeholder involvement - A well structured regulator-implementer-stakeholder dialogue
  - Acceptability of proposed optimum solution (end state, risk and cost)
  - Communication issues (terminology)

- **Ongoing and upcoming NEA activities**
  - Forum on Stakeholder Confidence (FSC)
  - NEA workshop on Stakeholder Involvement: Risk Communication - Dialogues Towards a Shared Understanding of Radiological Risks, 24-26 September 2019, Paris, France

R&D and Innovation Needs

- **Themes**
  - Characterisation and survey prior to dismantling
  - Technologies for segmentation and dismantling
  - Decontamination and remediation
  - Materials and waste management
  - Site characterisation and environmental monitoring



(NEA WPDD, 2014)

Embrace New Technologies

- **Innovative technologies**
  - Remote and robotic systems
  - Artificial Intelligence (AI)
  - Internet of Things (IoT)
  - Big data
  - Augmented Reality (AR)
  - Virtual Reality (VR)

Thank you for your attention

If you have questions of this presentation, contact Rebecca Tadesse [Rebecca.Tadesse@oecd-nea.org]

www.oecd-nea.org/rwm/