IAEA 60 Years
Atoms for Peace and Development

International Workshop on Application of Advanced Plant Information for Nuclear Decommissioning and Life Cycle Management

Lillehammer, Norway, 3-5 December 2018

IAEA Activities in Support of Decommissioning

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Decommissioning Specialist

Decommissioning and Environmental Remediation Section / Division of Nuclear Fuel Cycle and Waste Technology / Nuclear Energy Department

Outline of the Presentation

- Introduction to the IAEA
- Global Status of Decommissioning
- IAEA Support Activities for Decommissioning
- IAEA Supported Tools
- Recent Publications on Decommissioning

Introduction to the IAEA

IAEA Statute : Objectives

Established in 1957

169 Member States

~ 2,560 multidisciplinary professional and support staff from more than 100 countries

ATOMS FOR PEACE AND DEVELOPMENT

The Agency is tasked with accelerating and enlarging the contribution of atomic energy to peace, health and prosperity throughout the world.

IAEA: Main areas of work

Safeguards and Verification

Safety and Security

Science and Technology

Gather Best Practices, Support Scientific Development
Publications, Coordinated Research Projects

Peace

Development

Disseminate Information and Support Programmes
Networks, Peer Reviews, Technical Cooperation Projects

Sustainable Developments Goals

1.5°C Challenge

TODAY

70%

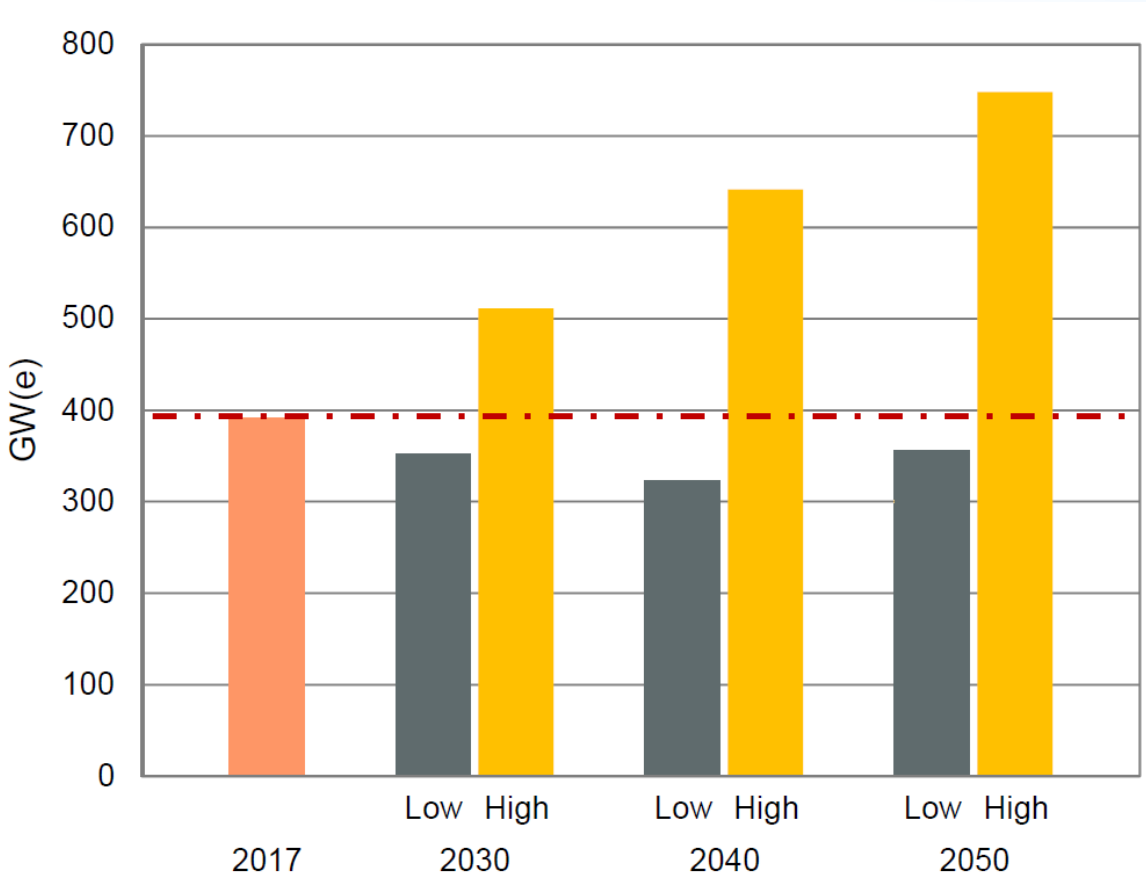
of electricity comes from **burning fossil fuels**

2050

≈80%

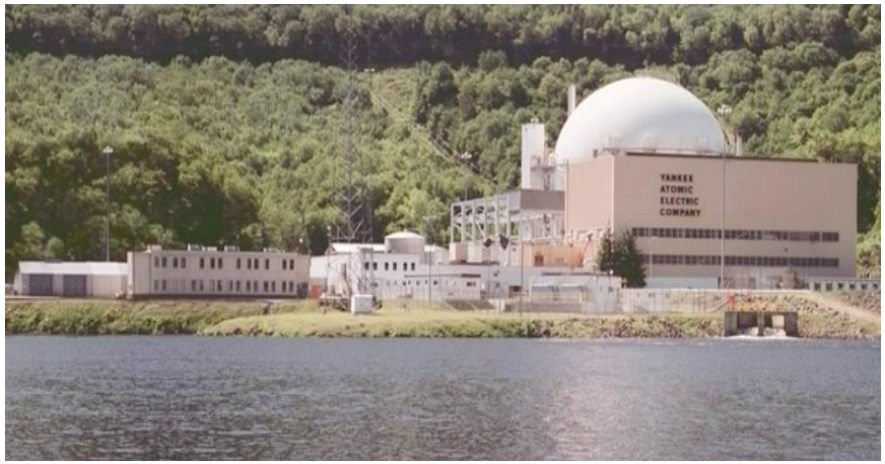
of electricity will need to be **low carbon**

IAEA Projections



Global Status of Decommissioning

Decommissioning Today



Ignalina Nuclear Power Plant, Lithuania

NPP Decommissioning Realizations, FRANCE

Creys tunnels cutting

Chinon heat exchanger dismantling

Chooz SG decontamination and shipping in one piece

Chooz steam generator lifting

Creys Charli robot laser cutting for residual sodium treatment

Creys Malville : sodium treat

Bugey radiological characterization

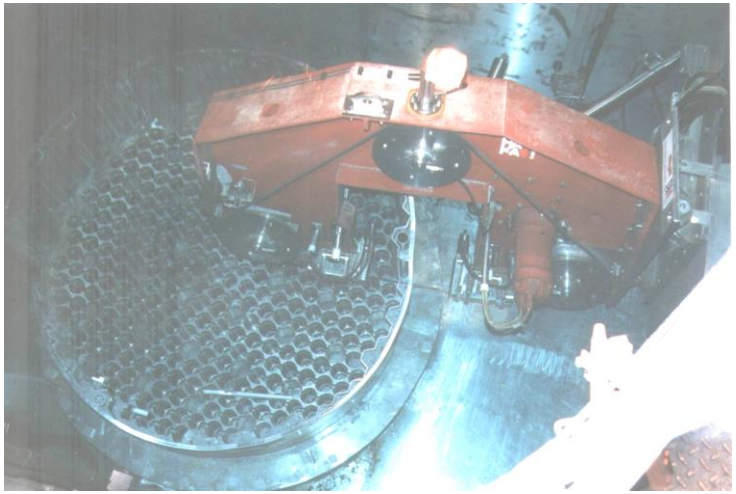
Bugey pumping station dismantling

Brennilis land remediation

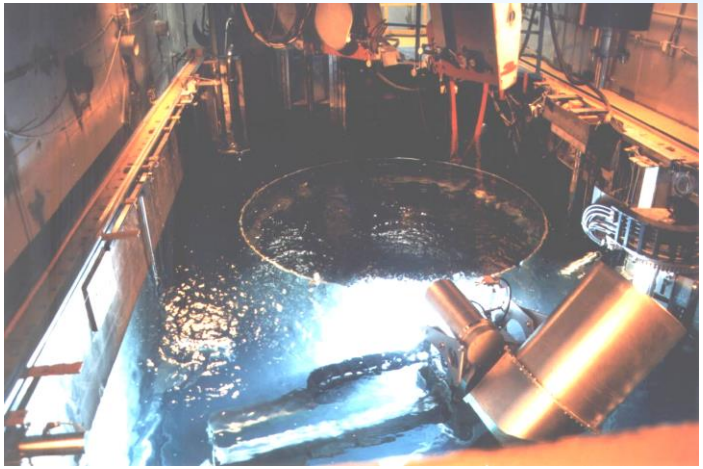
Bugey internal measuring and inspections

Example of NPP Decommissioning Realizations, GERMANY

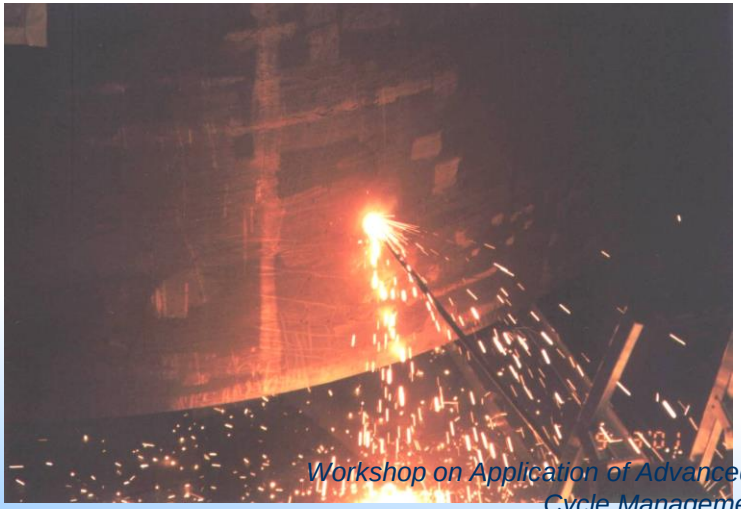
Greifswald internal components mechanical cutting



Greifswald plasma burner cutting



Greifswald Oxygen lance cutting



Greifswald end state - reuse of the turbine hall

José Cabrera (Spain): Progress and Achievements

José Cabrera NPP

Building Decontaminatio n. General Progress: 70%

Reactor Building Disassemblies: 100%

Decom.Aux.Build. (EAD) 100% (Other uses)

Soils Decontaminatio n. General Progress: 5%

OTHER AREAS

Auxiliary Building Disassemblies: 100%

Electrical Building Disassemblies: 100%

Source: ENRESA

(May 2018)

NPP Decommissioning Realizations, USA

Fort st Vrain concrete cutting

Maine Yankee vessel lifting

Maine Yankee concrete containment demolition

Maine Yankee end state

Connecticut Yankee land remediation

NP Reactors

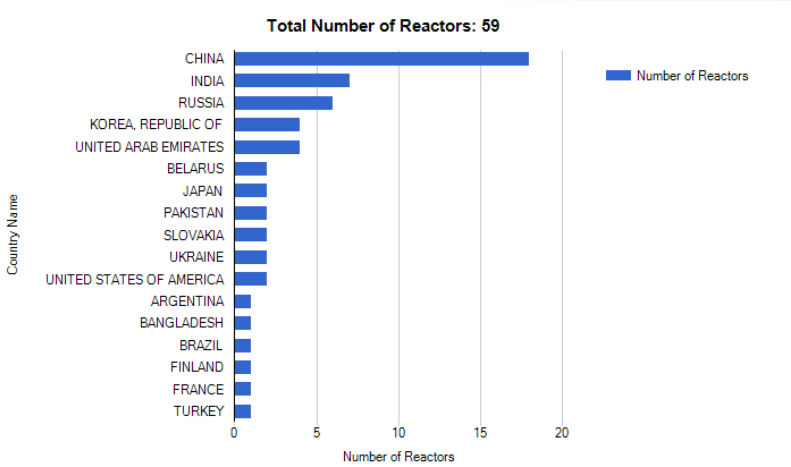
(as of 12 October 2018)

452 in operation

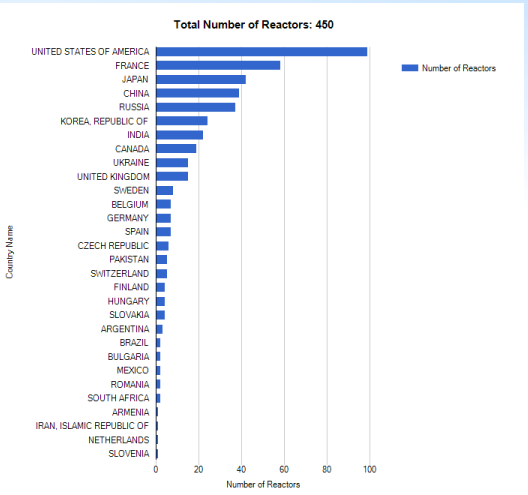
398 GW(e) Capacity

55 under construction (2/3 in Asia)

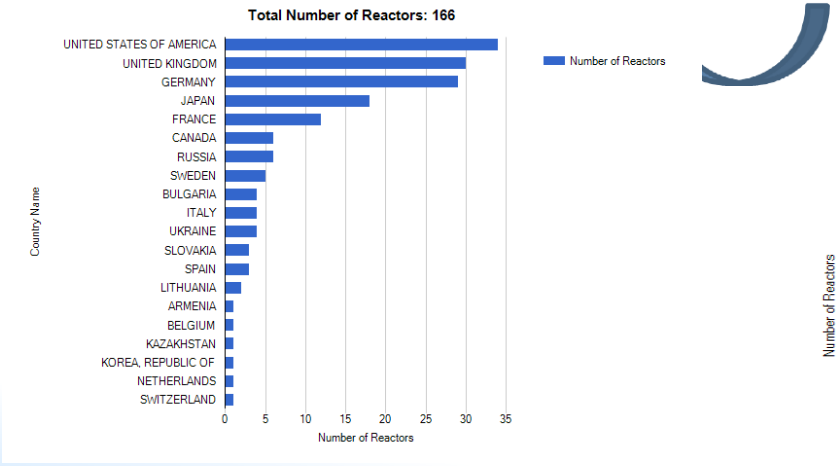
Power Reactors Worldwide : Life Cycle View



59 reactors under construction

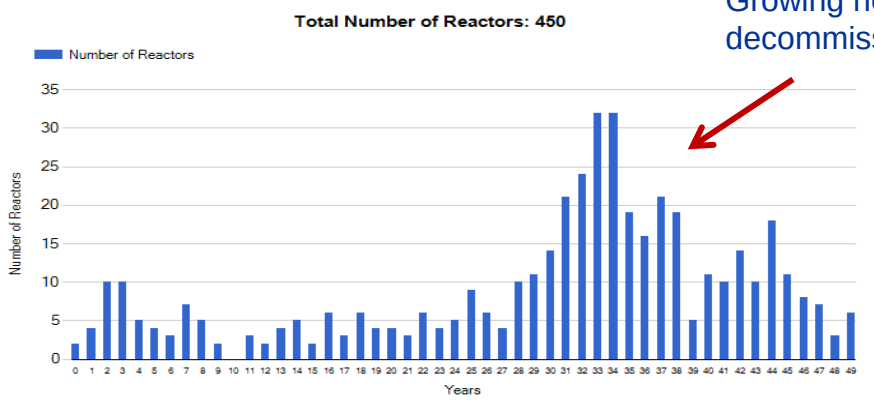


450 reactors in operation



166 power reactors permanently shutdown

Growing needs of decommissioning



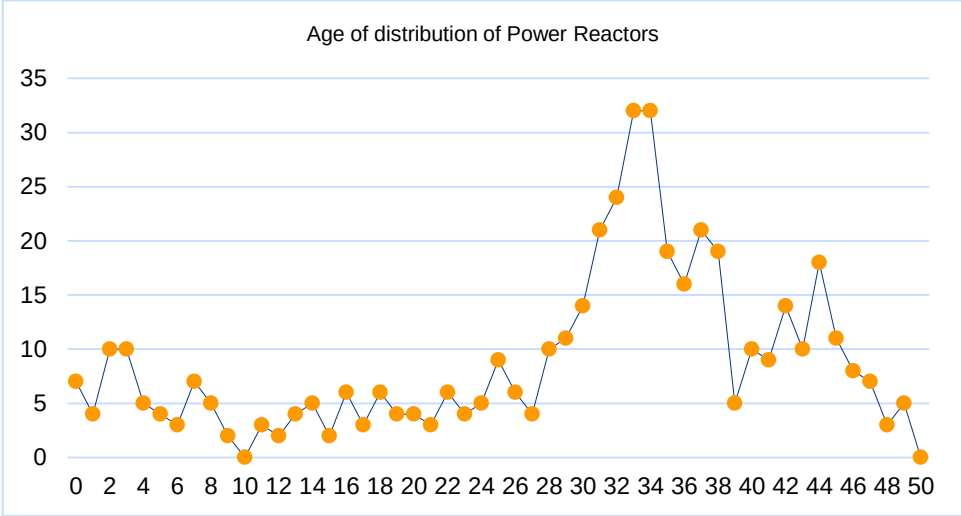
50%+ > 30 years old

Global Status of Nuclear Facilities

[Sources: IAEA PRIS; Research Reactor Databases]

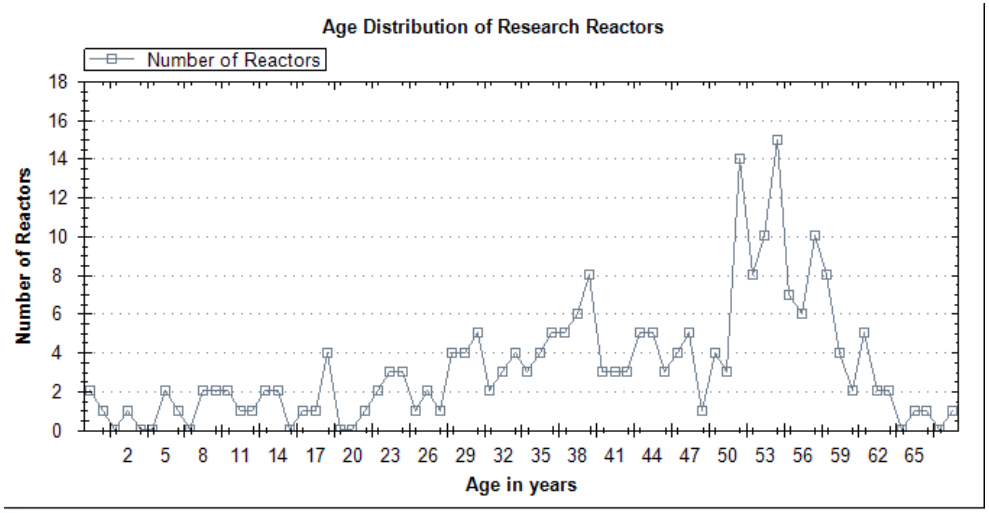
Power reactors [PRIS]

In Operation	452
Permanent Shutdown / Decommissioned	169
	621



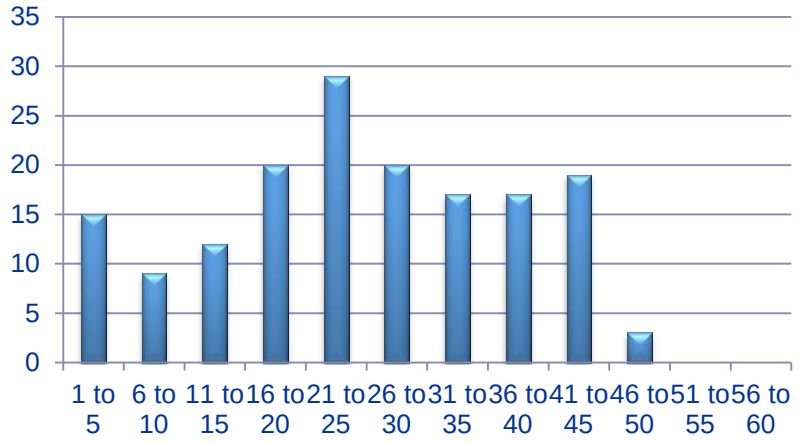
Research reactors & critical assemblies [RRDB]

In Operation	226
Temporary / Extended Shutdown	26 (13 / 13)
Permanent Shutdown / Under Decommissioning / Decommissioned	566 (56 / 67 / 443)
	818

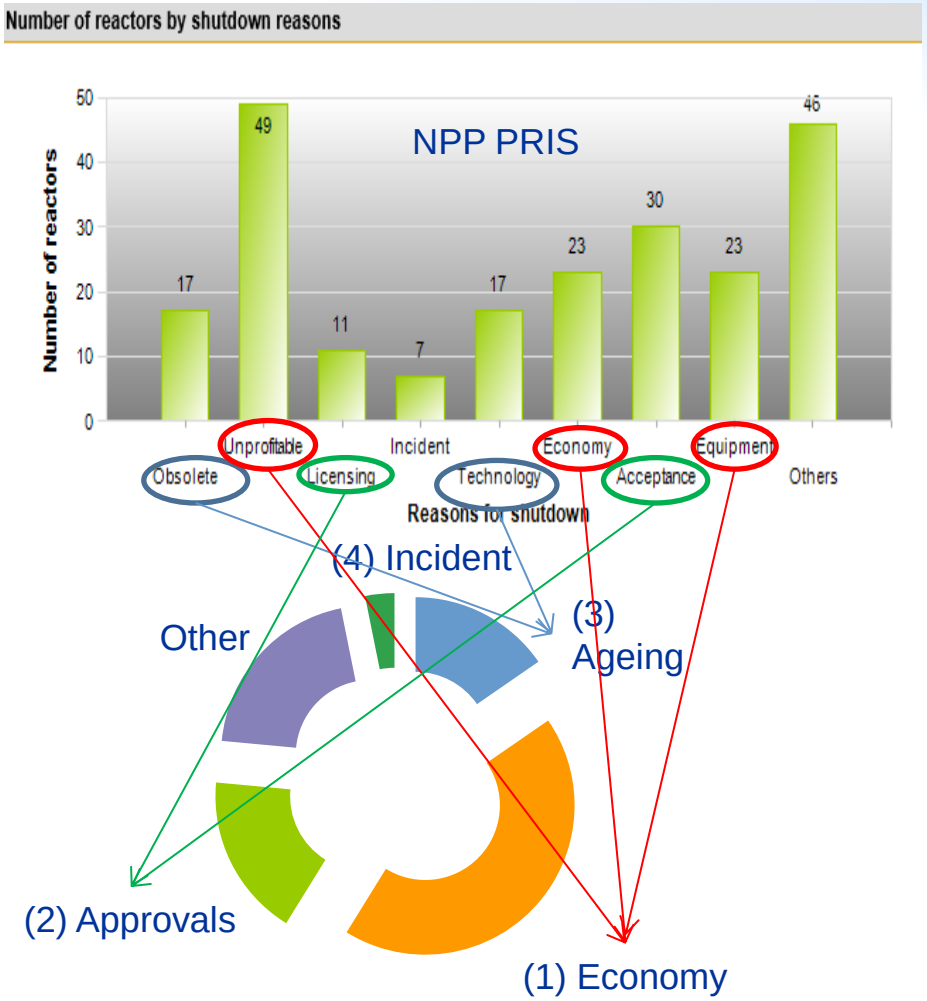


Reasons for NPP Shutdowns *[Source: IAEA PRIS Database]*

Age of NPP at shutdown



Reactor types
30% PWR 27% GCR 24% BWR 7% PHWR 5% LWGR

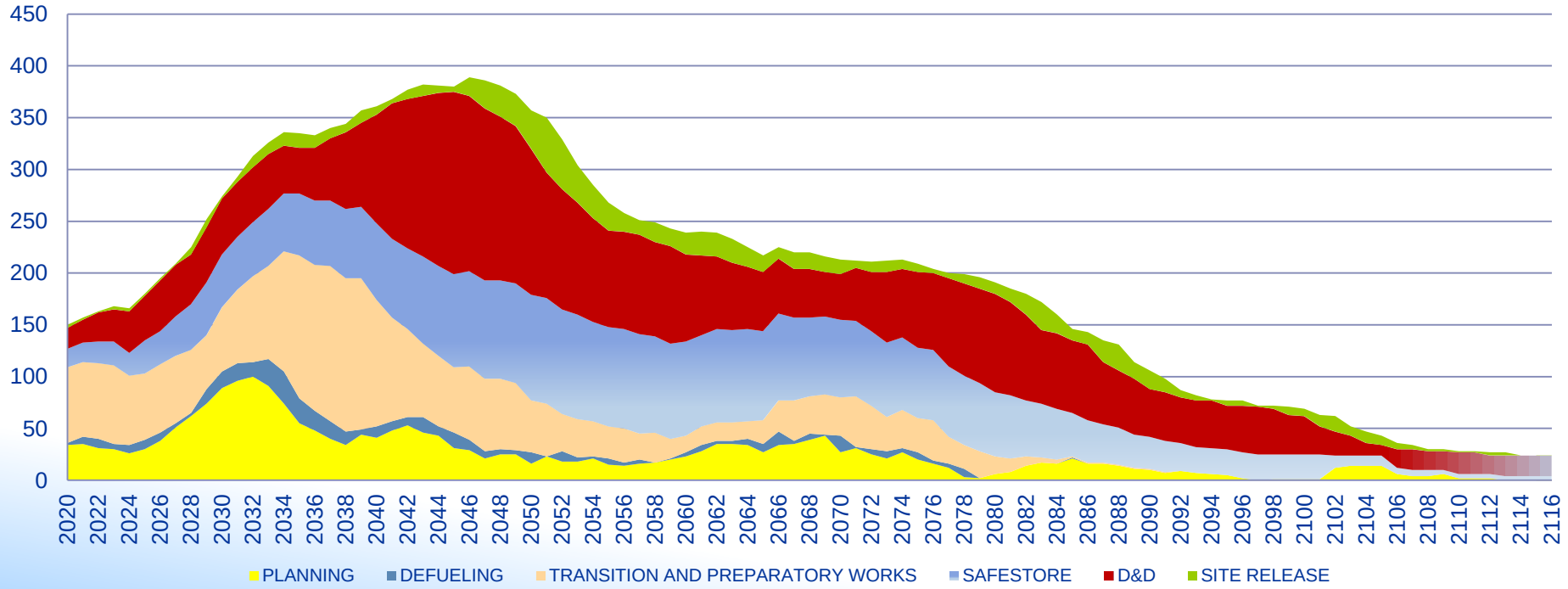


Decommissioning main phases

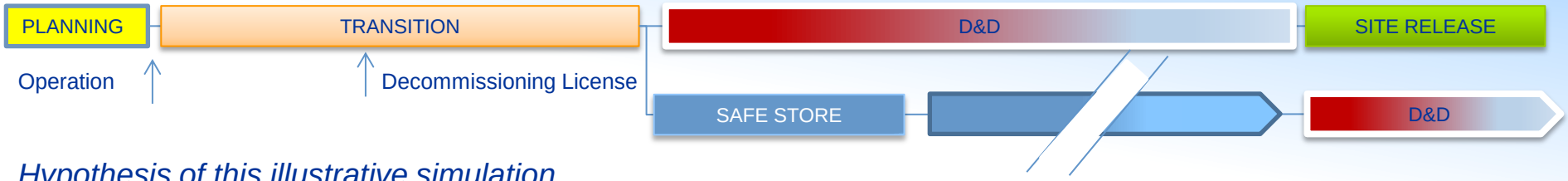
Hypothesis of this illustrative simulation

- *Shutdown after 50 years assumed unless actual timeframes are known*
- *Immediate or deferred dismantling strategy applied when known*
- *Immediate dismantling is assumed when no decommissioning timeframe has been announced*

Number of reactor in decommissioning estimates based on Illustrative scenario



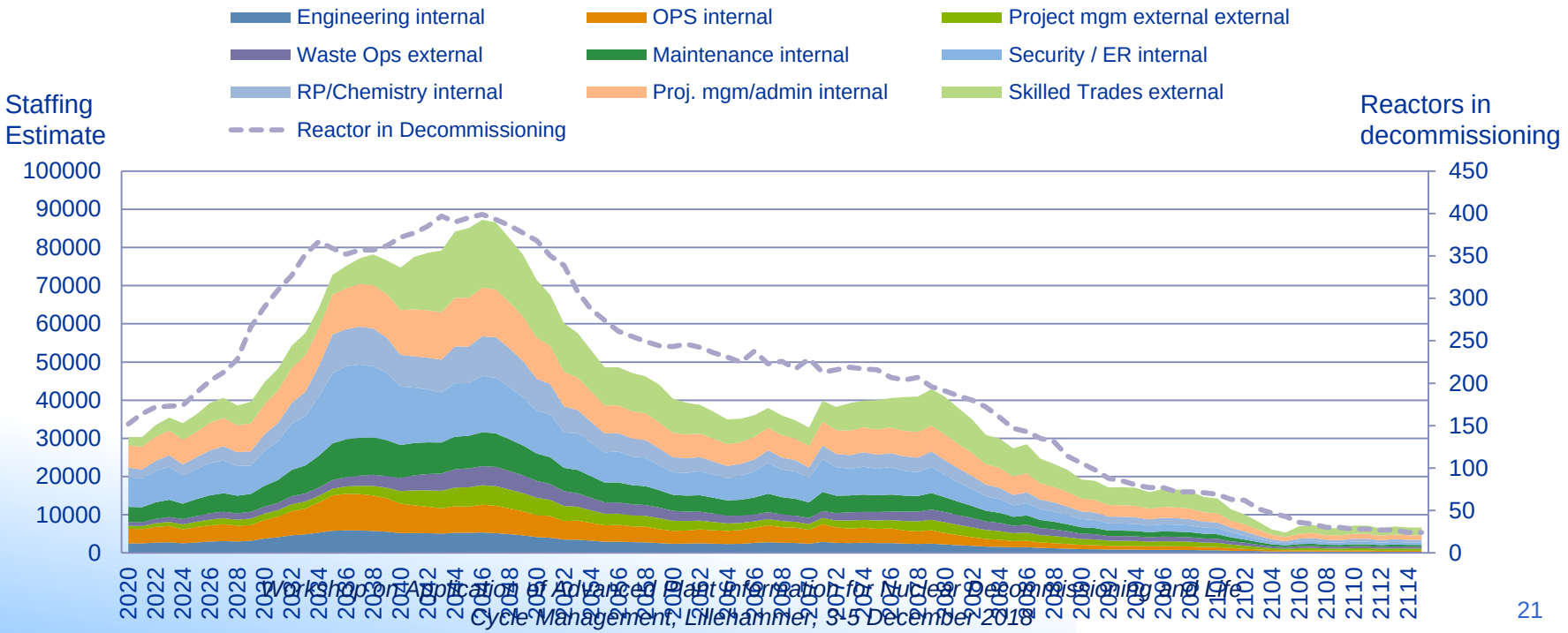
Decommissioning main phases



Hypothesis of this illustrative simulation

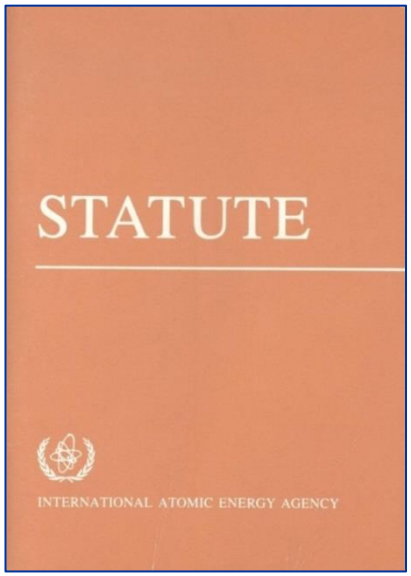
- *Shutdown after 50 years assumed unless actual timeframes are known*
- *Immediate or deferred dismantling strategy applied when known*
- *Immediate dismantling is assumed when no decommissioning timeframe has been announced*

Staffing for decommissioning - skills distribution
Worlwide estimate based on illustrative scenario



IAEA Activities to Support Decommissioning

IAEA Statute



Article 3 *Functions*

A. The Agency is authorized:

….

3. To foster the exchange of scientific and technical information on the peaceful uses of atomic energy
4. To encourage the exchange and training of scientists and experts in the field of peaceful uses of atomic energy

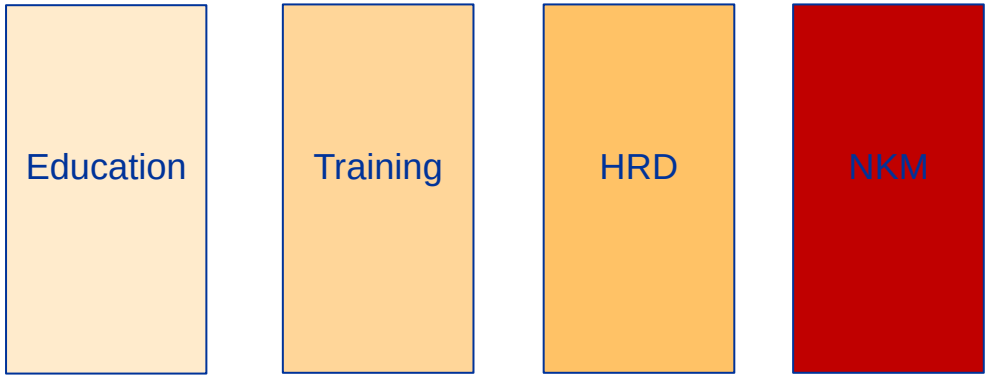
Article 8 *Exchange of information*

A. Each member should make available such information as would, in the judgement of the member, be helpful to the Agency

B. ..

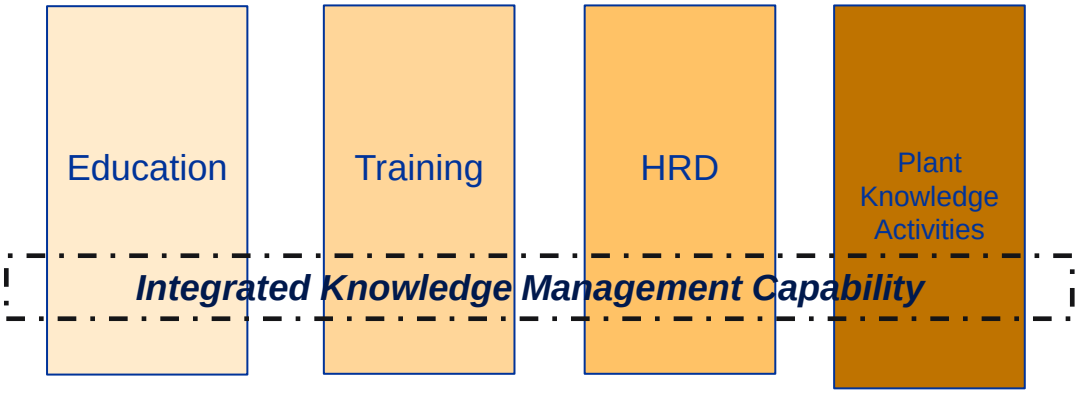
C. The agency shall take positive steps to encourage the exchange among its members of information relating to the nature and peaceful uses of atomic energy and shall serve as an intermediary among its members for this purpose.

So this is where we started from across nuclear energy around the world 20 years ago …



Because the nuclear organisations needed to start like this …

Current Approach to NKM across the Nuclear World



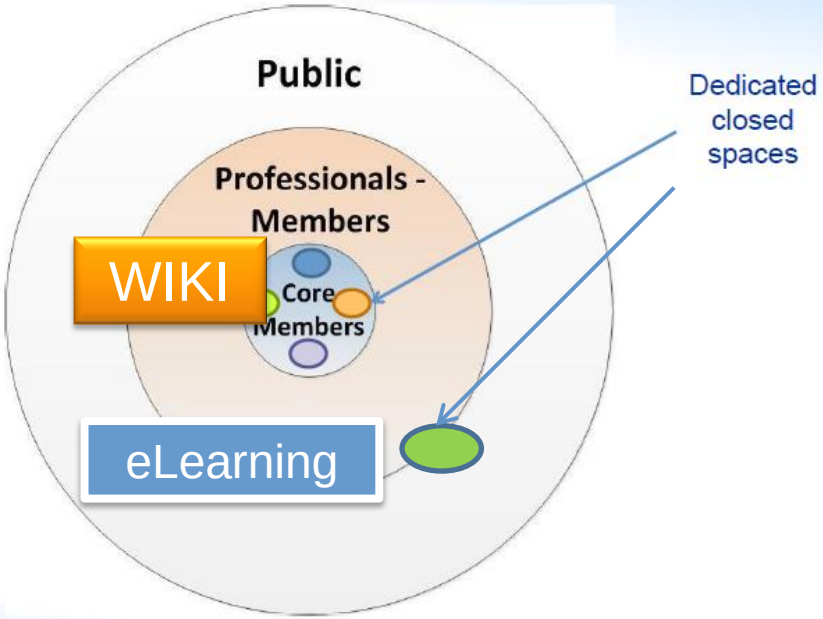
Because the nuclear organisations know what to do, and understand to add value NKM must be integrated across people and plant activities

Decommissioning-Related Training Events in 2018

Training Event	Host/Location	Date
Workshop on safety assessment of sites for decommissioning and remediation *[INT/9/183]*	Argonne, US	24 April – 04 May
Regional workshop processes for end state selection and site release criteria for NPPs *[RER/9/150]*	Slavutych, UA	27-31 August
Regional Workshop on decommissioning planning and cost estimation for decommissioning *[RER/9/150]*	Bratislava, SK	17-21 September
Regional Workshop on role of IT in knowledge management for decommissioning *[INT/9/183]*	Halden, NO	05-09 November
Regional Workshop on safety aspects of near surface disposal of radioactive waste *[RER/9/150]*	Kozloduy, BG	12-16 November
Regional Workshop on technologies for waste characterization and processing *[RER/9/150]*	Visaginas, Lithuania	19-23 November
Regional Workshop on Decommissioning Planning and Supporting Safety Documentation *[INT/9/146]*	Dunshanbo, Tajikistan	01-05 March 2019

IAEA Supported Tools

Web Portal, Networks and e-Tools



For Members: Webinars, Live Streaming, Advanced review of documents, ….

Web Portal, Networks and e-Tools

First Level

General Introduction and Briefing
What are we talking about ? What are the stakes?

For any stakeholder

Second Level

How to put into practice, How to implement
Core curriculum of a one-week or multi-week programme

For Practitioners

IAEA Supported Tools

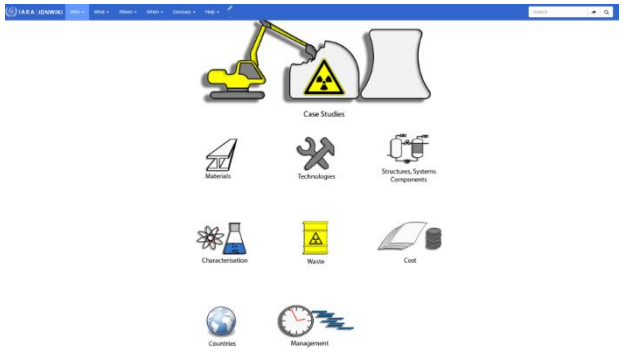
IAEA Support: E-learning for stakeholders and newcomers to the field

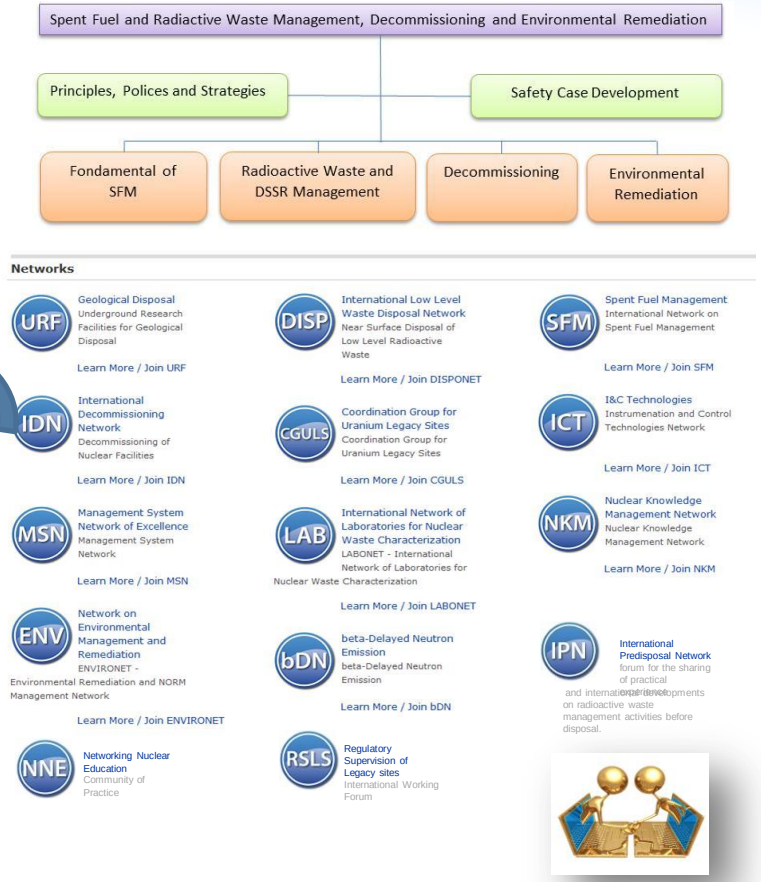
https://nucleus.iaea.org/sites/connect-members/LMS/Pages/Welcome-to-the-learning-materials-section.aspx

IAEA Support: Networks Web Based Tools to support information sharing

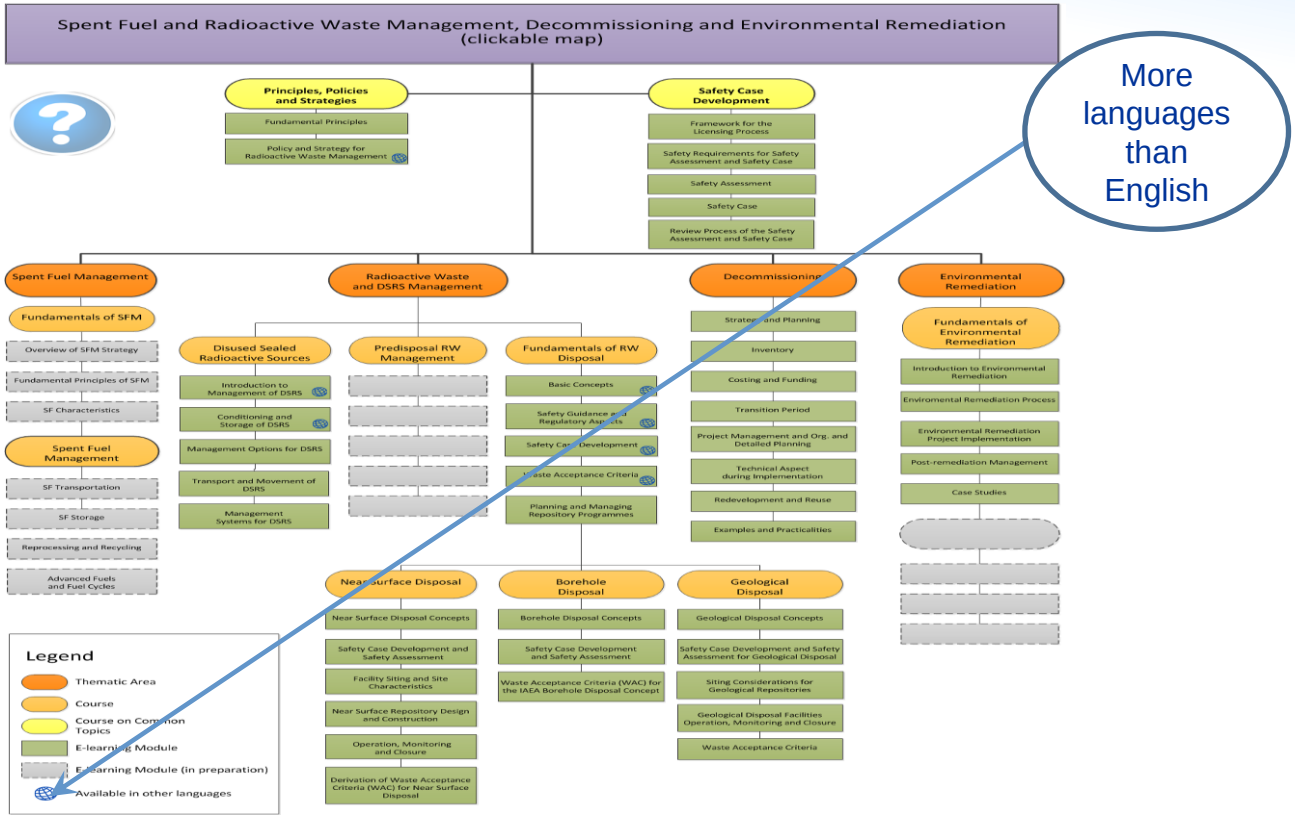
https://nucleus.iaea.org/sites/connect/Pages/default.aspx

Launched in 2016 : WIKI





E-learning / Briefing Material
For Stakeholders and Professionals

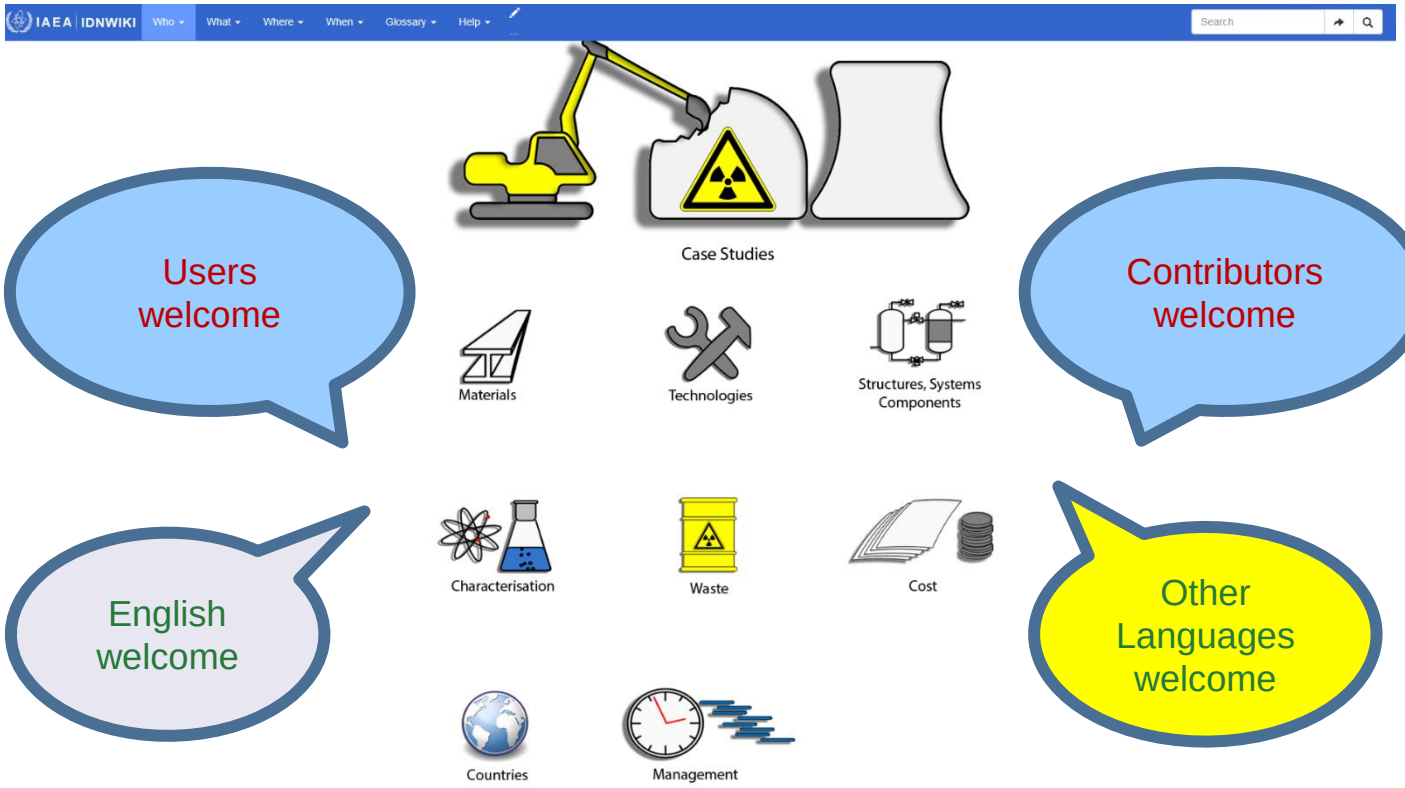


CLP4Net

Target Audience? – MS organizations interested in nuclear capacity building

- Agency wide Learning Management System
- Internal users: 26 Sections from 14 Divisions of 5 IAEA Departments
- External Users: Regional Education networks and Co-operation partners
- Over 22,000 registered users
- Very successful product

WIKI



https://idn-wiki.iaea.org/wiki/Main_Page

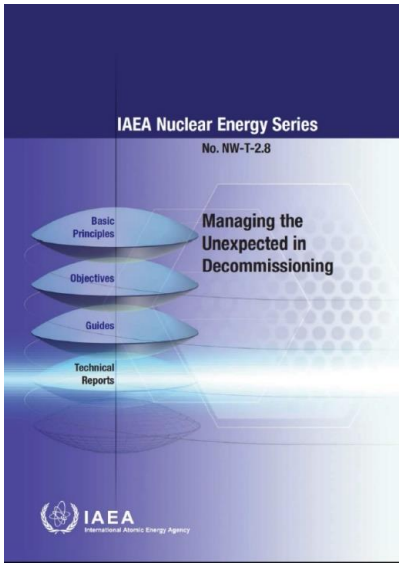
Peer Reviews – ARTEMIS

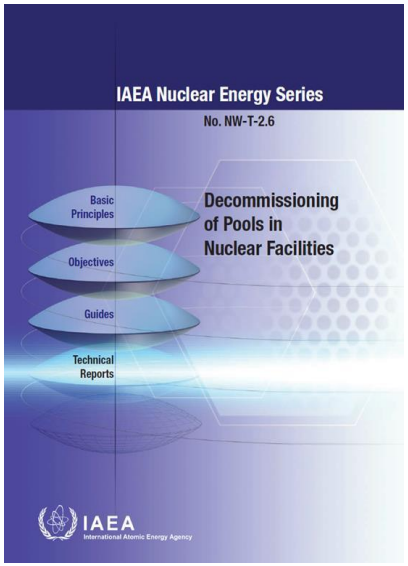
- Main objectives: to provide independent expert opinion and advice to MS
  - IAEA put together a team of international experts
- Intended for facility operators and other implementing organizations, regulators, government agencies, policy makers

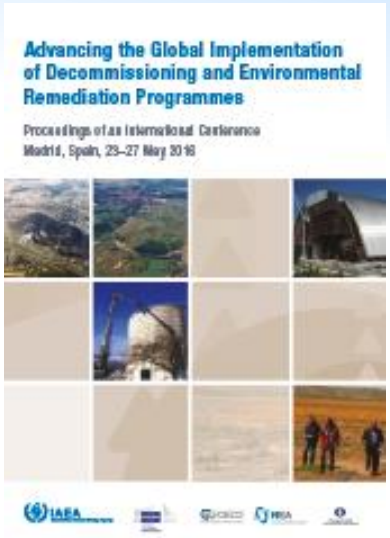
First reviews are already taking place

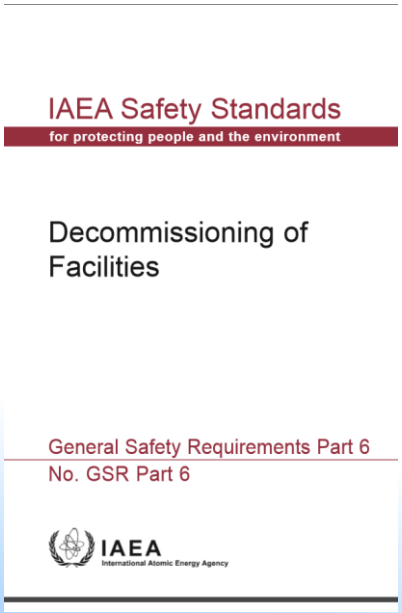
- Scope can include facilities and activities related to:
  - Spent nuclear fuel and RW management,
  - Decommissioning,
  - Environmental remediation.

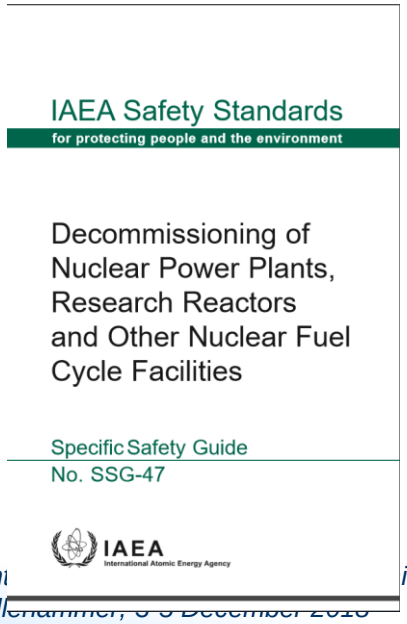
Recent Technical and Policy Publications











References

- IAEA SF-1 Safety Fundamentals (2006)
- IAEA WS-R-2 Predisposal Management of Radioactive Waste, Including Decommissioning (2000)
- IAEA WS-R-5 Decommissioning of Facilities Using Radioactive Material (2006)
- IAEA Safety Series Guide WS-G-2.1 Decommissioning of Nuclear Power Reactors and Research Reactors (1999)
- IAEA Safety Series Guide WS-G-2.2 Decommissioning of Medical, Industrial, and Research Facilities (1999)
- IAEA Safety Series Guide WS-G-2.4 Decommissioning of Nuclear Fuel Cycle Facilities (2001)
- IAEA RS-G-1.7 Application of Concepts of Exclusion, Exemption and Clearance

http://www-pub.iaea.org/MTCD/publications/publications.asp

References

- IAEA WS-G-5.1 – Release of Sites from Regulatory Control on Termination of Practices (2006)
- Safety Reports Series No. 50 Decommissioning Strategies for Facilities Using Radioactive Material (2006)
- IAEA TECDOC-1478 Selection of Decommissioning Strategies: Issues and Factors (2005)
- IAEA Technical Reports Series No. 375, Safe Enclosure of Shutdown Nuclear Installations (1995)
- IAEA TECDOC-1124, On-Site Disposal of Nuclear Facilities as a Decommissioning Strategy (1999)

IAEA 60 Years
Atoms for Peace and Development

Thank you!

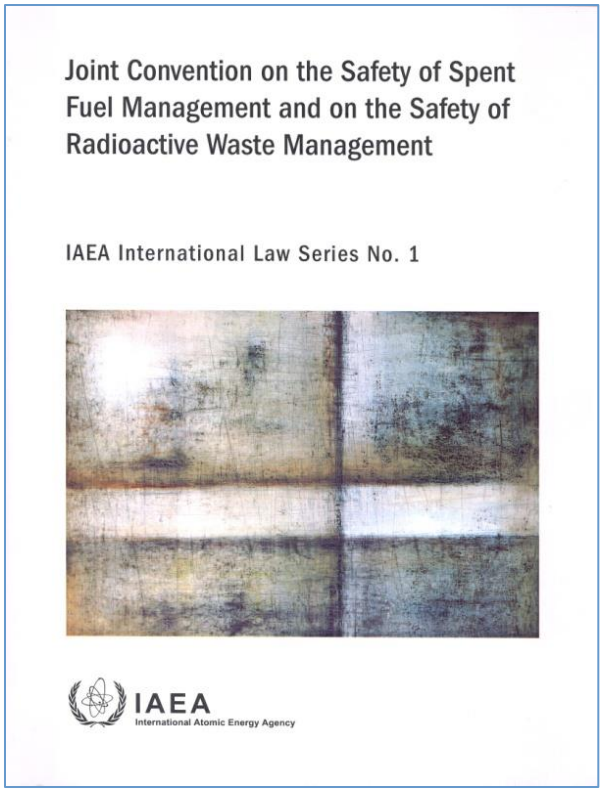
@IAEANE

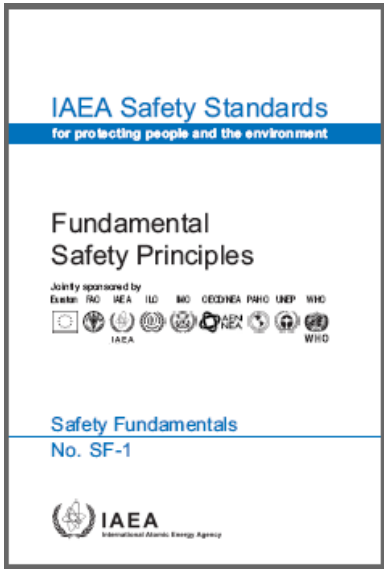
www.iaea.org/nuclearenergy

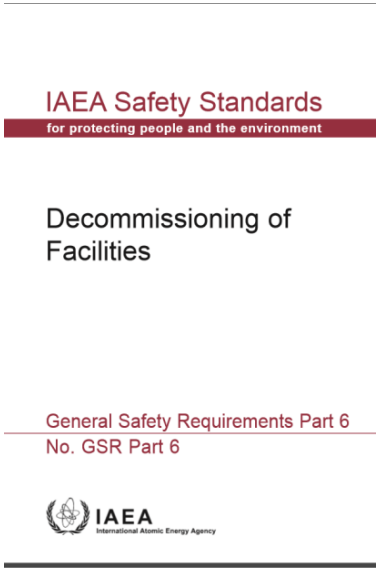
BACKUP SLIDES

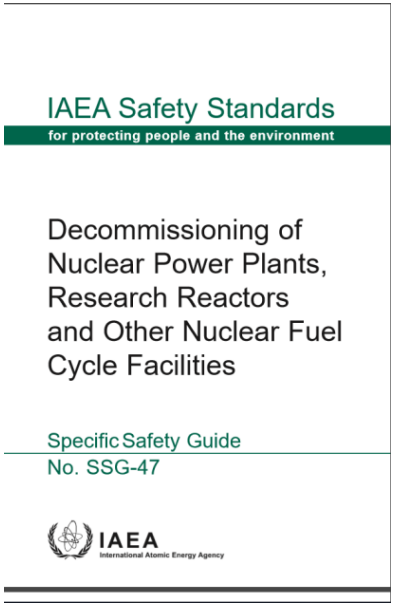
Global Nuclear Safety Regime

The Nuclear Safety Regime applied to Radioactive Waste Management



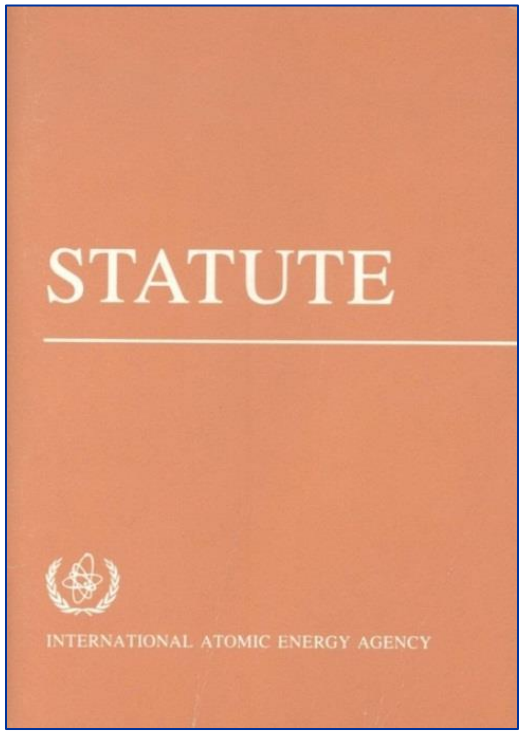






- National Policy and Strategy

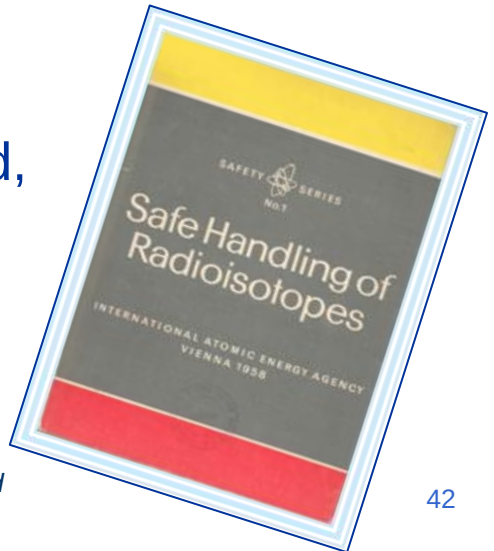
IAEA Statute



The IAEA Safety Standards have a status derived from the IAEA's Statute, which authorizes the IAEA:

"To establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property ... and to provide for the application of these standards".

In **1958**, the IAEA published its first Safety Standard, Safety Series No. 1, **Safe Handling of Radioisotopes**. Over the years, more than 200 publications have been issued in the Safety Series.



Background: Mandate (2)

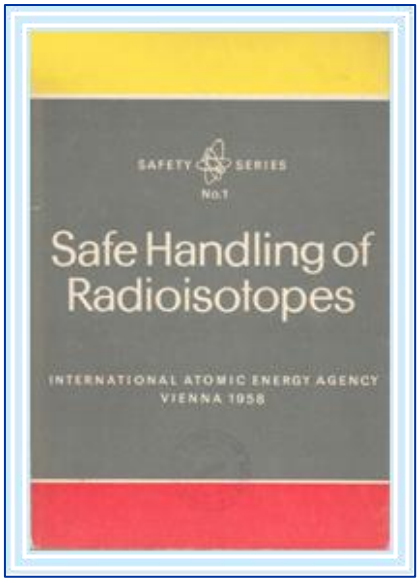
- IAEA Statute:
  - **Develop safety standards**

Nuclear safety
Radiation Safety
Waste Safety
Transport Safety

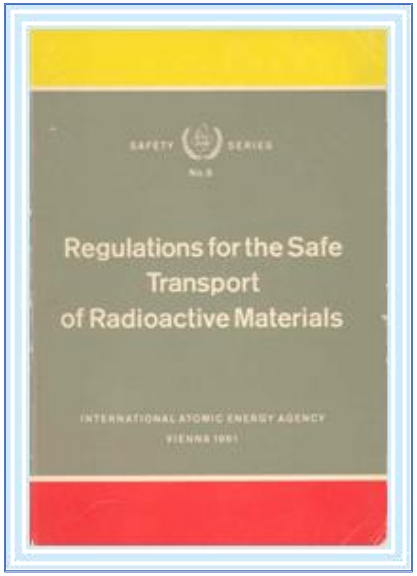
  - **Provisions for their application and guidance on good practices**

Peer reviews
Technical cooperation
Research and development
Training
Exchange of information (networks)

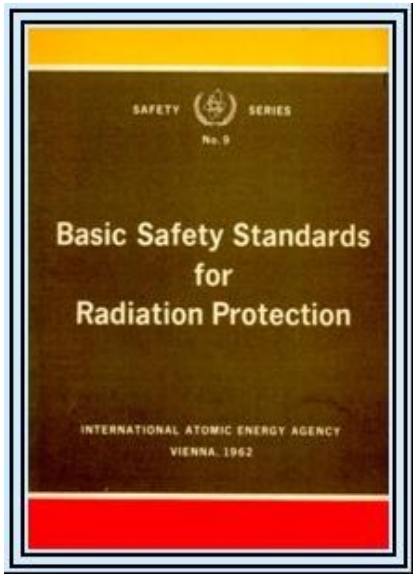
Historical milestones



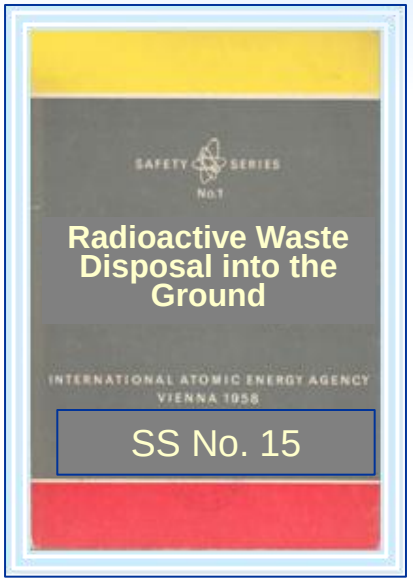
1958



1961

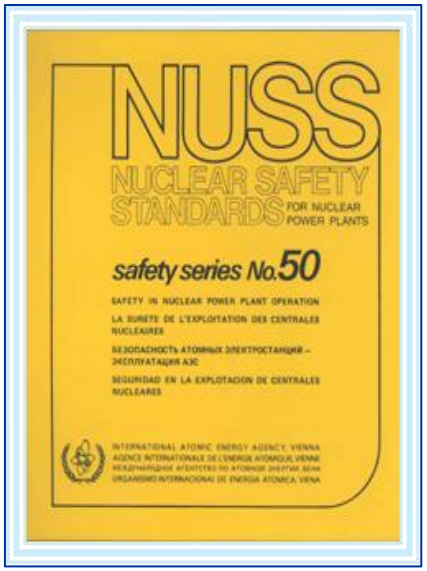


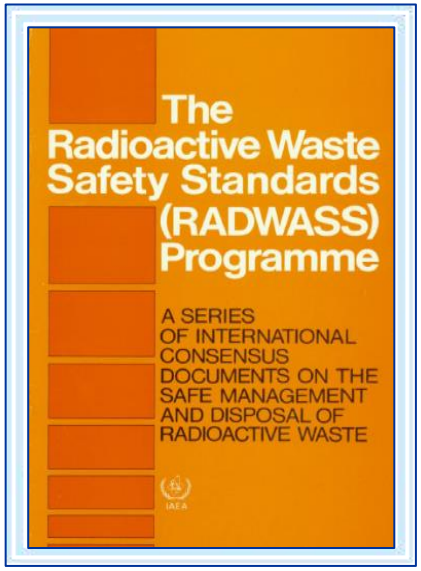
1962

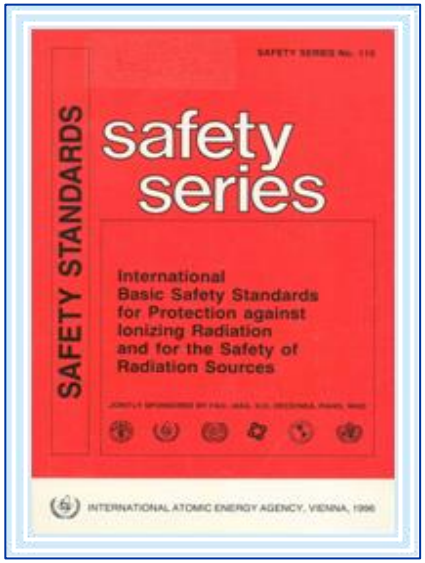


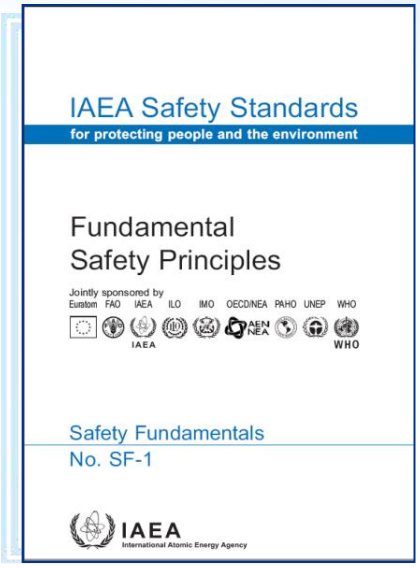
1965

Historical milestones (cont.)



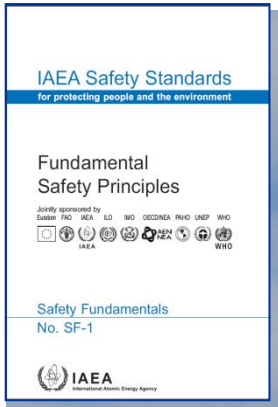






1974 1988 1996 2006

Hierarchy of Safety Standards



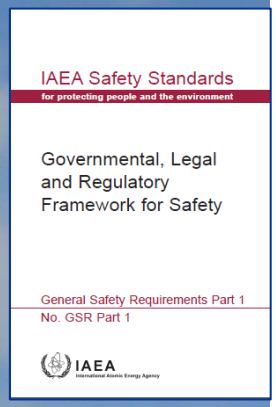
Principles for protecting people and environment

Safety Fundamentals

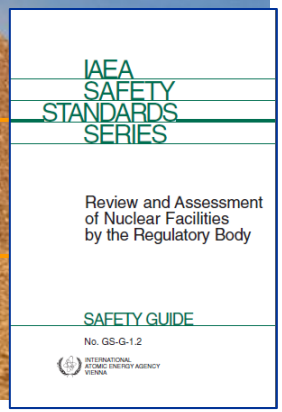
Safety Requirements

Safety Guides

Supporting publications



Requirements to be applied to meet the principles



Recommended ways of meeting the requirements

Hierarchy of Safety Standards