



The European Commission's
science and knowledge service
Joint Research Centre

Nuclear Decommissioning in a European Perspective

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JRC, Euratom Coordination unit

BVS.ABR scientific meeting

Radiation Protection and Decommissioning

Brussels, 17 May 2019



why

***should we progress with nuclear
decommissioning?***



content of the presentation

1. the **context** of the decommissioning in Europe
2. the role of the **European Union**
3. building **expertise** in nuclear decommissioning
4. **conclusions**

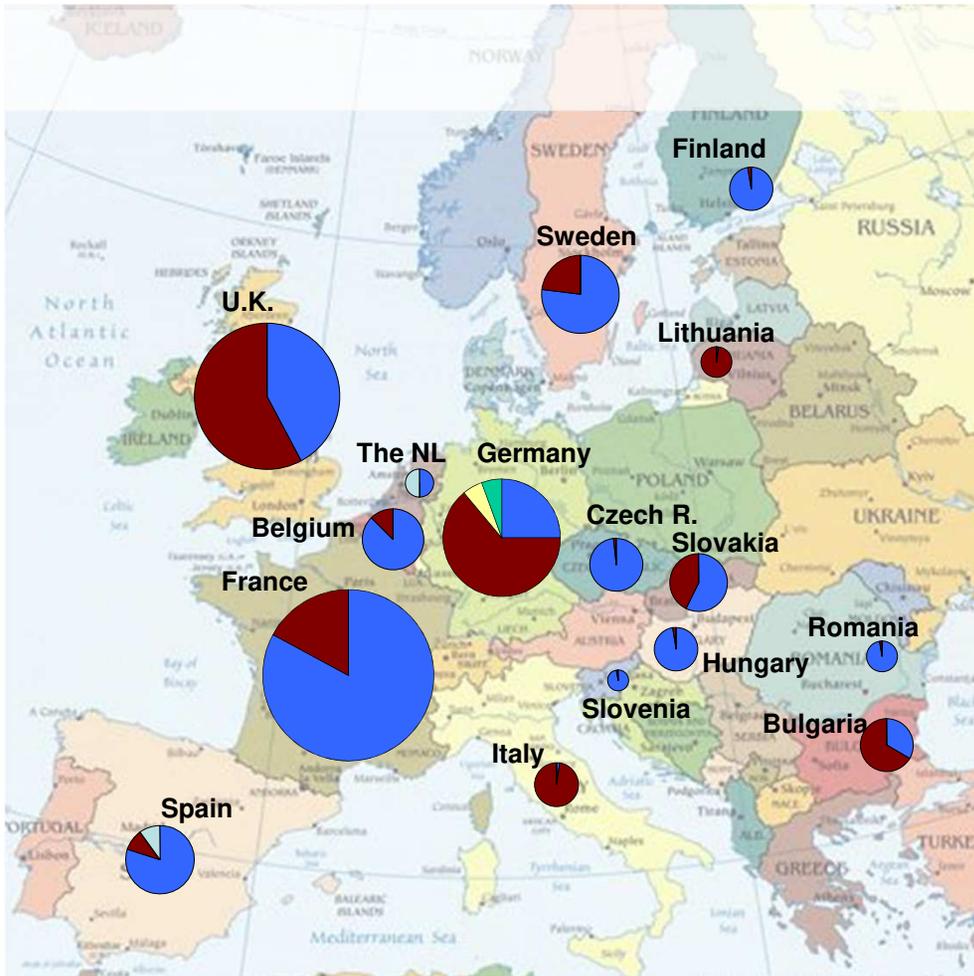
1. the **context of nuclear decommissioning in Europe**

2. the role of the European Union

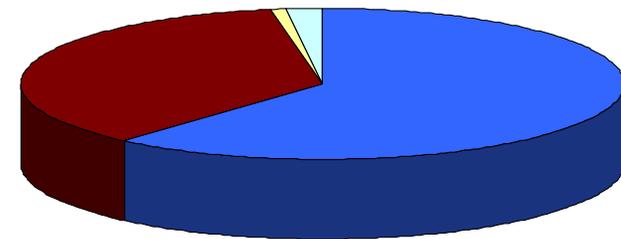
3. building expertise in nuclear decommissioning

4. conclusions

situation nuclear power reactors in the EU

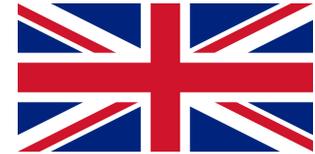


- Operational
- Shutdown - Dismantling
- Fully Dismantled
- Long Term Safe Enclosure



TOTAL
Power reactors in EU: 222
Operating reactors: 131

decommissioning in the United Kingdom



Businesses

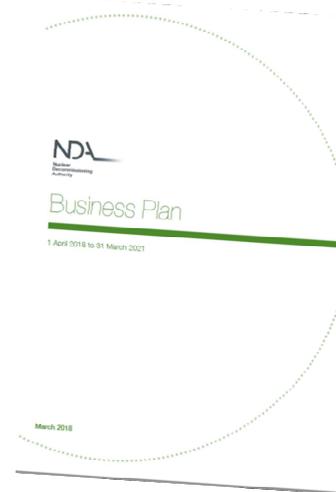
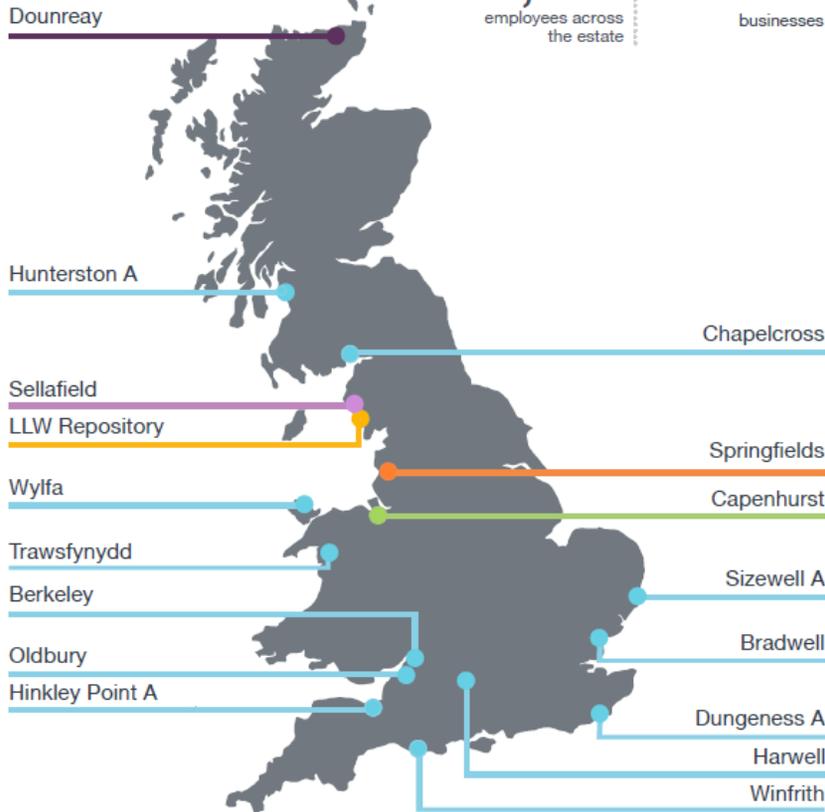
- Sellafield Ltd
- Magnox Ltd
- Dounreay Site Restoration Ltd
- LLW Repository Ltd
- Springfields Fuels Ltd
- Capenhurst

1,046
hectares of nuclear
licensed land

17
sites dating from
post-war decades

16,000
employees across
the estate

12
businesses



budget 2018/2019:
£ 3,146 billion

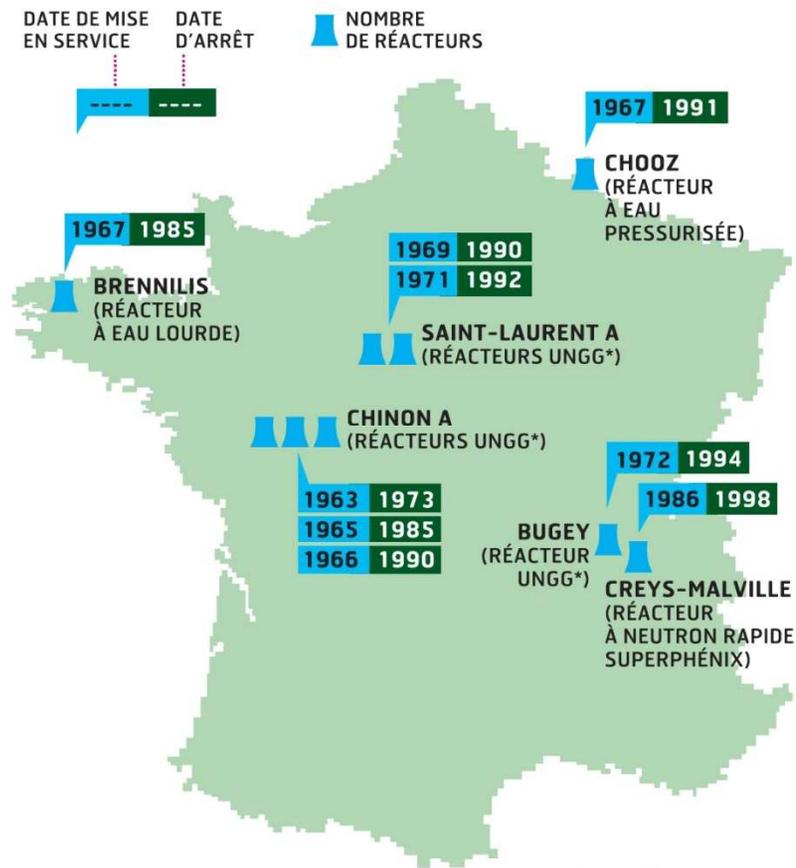


source: NDA



decommissioning of power reactors in France

LES 9 RÉACTEURS D'EDF EN COURS DE DÉMANTÈLEMENT



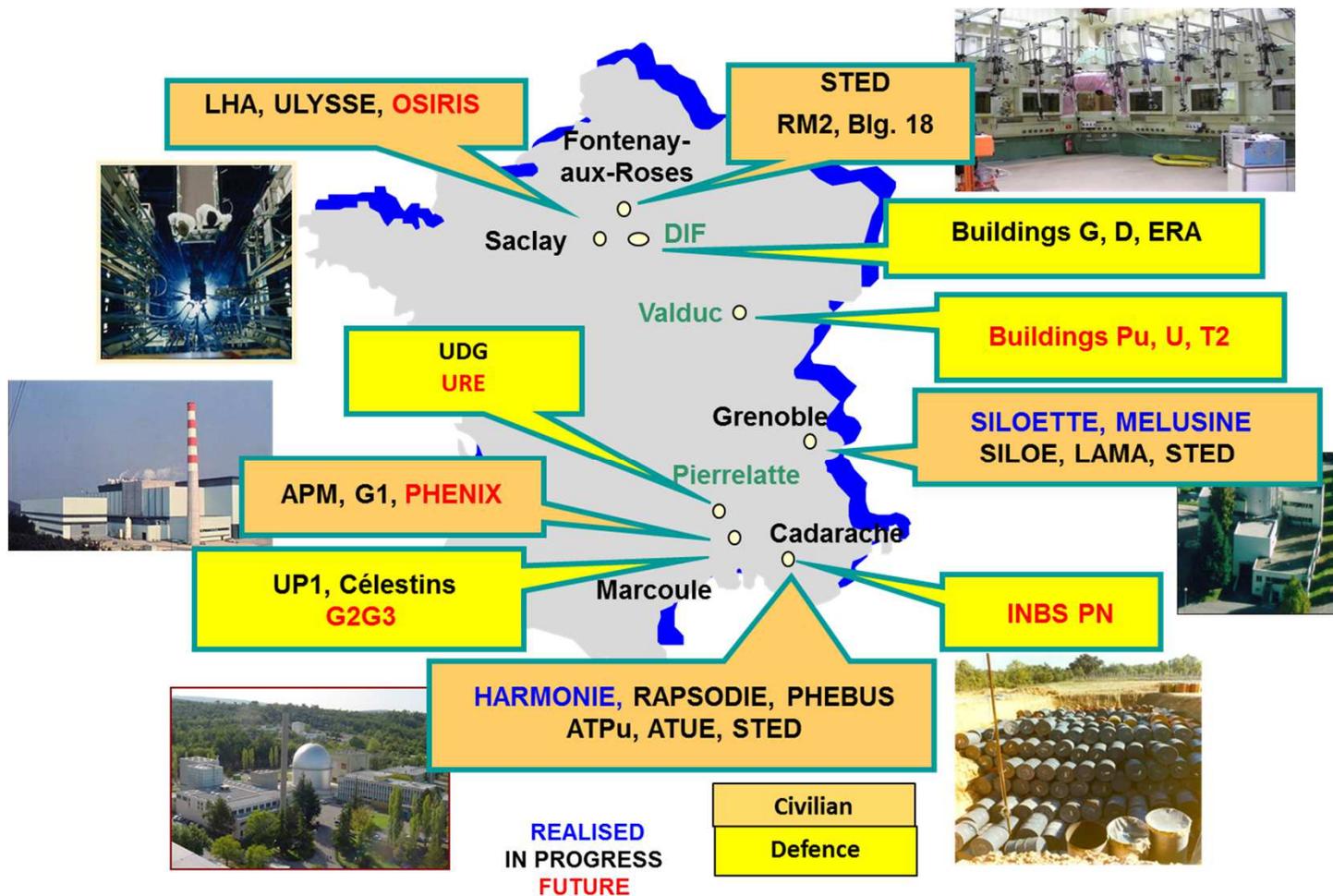
« LES ÉCHOS » / SOURCE : EDF

* URANIUM NATUREL GRAPHITE GAZ

source: EDF



decommissioning projects of the CEA



source: CEA

situation in Italy



EUREX Plant
Saluggia (VC)



Power Plant
Trino (VC)



FN Plant
Bosco Marengo (AL)



Power Plant
Caorso (PC)



Power Plant
Latina



IPU and OPEC Plants
Casaccia (RM)

Planning, Engineering and Procurement
Rome

Power Plant
Garigliano (CE)



ITREC Plant
Rotondella (MT)



source: SOGIN

situation of the nuclear installations in Spain



decommissioning in Lithuania, Slovakia, Bulgaria



Lithuania



power plant of Ignalina
2 x RBMK 1500 MWe



Bulgaria



power plant of Kozloduy
4 x VVER 440 MWe



Slovakia



power plant of Bohunice
2 x VVER 440 MWe

Co-financing by the EU



nuclear reactor decommissioning cost estimates

- **Current cost estimates: between 300 et 2700 M€ /GWe**
- **Main cost drivers are:**
 - Reactor type
 - Site condition (number of units)
 - **Countries and national requirements (safety and waste routes)**
 - **Duration of the project...**

source: EC, Nuclear Illustrative Programme, 2017

context of nuclear decommissioning in the EU

- Currently, industrial experience exists, good progresses are made, particularly with the decommissioning of reactors however...

... further attention is necessary for:

- ✓ **Development** of the most suitable techniques, with respect to safety, efficiency and waste limitation;
 - ✓ **Standardisation** and harmonisation (incl. cost estimation);
 - ✓ Offering and promoting dedicated **education and training** opportunities;
 - ✓ **Sharing knowledge** and experiences.
-
- *Coordinated EU approaches may provide advantages.*

1. the context of nuclear decommissioning in Europe
- 2. the role of the European Union**
3. building expertise in nuclear decommissioning
4. conclusions



European
Commission

European Commission

33 Directorates General (DG) and 11 Services



role of the European Commission (EC) in nuclear decommissioning

DG ENER Energy

Policy & Legislation

main Directives linked
to decommissioning:

- 'waste directive'
- 'basic safety standards' (RP)
- 'nuclear safety directive'

nuclear
decommissioning
assistance programme

DG JRC

Joint Research Centre

Policy support,
Direct research &
training

technical and scientific
support to other DG's

research & training in
decommissioning

JRC's
decommissioning
programme

DG RTD

Research & Innovation

Indirect research
and training actions

past Framework
Programmes 4 to 6,

current H2020 &
next Framework
Programme 9

DG DEVCO

Development & Cooperation

Support to non-EU
countries

addressing nuclear
liabilities through the
'Instruments for nuclear
safety Cooperation'
(INSC)



European
Commission

'Waste Directive' 2011/70/Euratom main elements

National policy

General principles

National framework

(legislative, regulatory and organisational)

Allocates responsibilities and provides for coordination
between relevant competent bodies

National programme

Covers all types of SF and RW and all stages of their management
from generation to disposal

'Waste Directive' 2011/70/Euratom follow-up of the implementation

- Member States to present their **National Programme and Inventory** in 2015, and every three years a **National Report** (2015, 2018, ...)
- **Commission reported** to the Council and European Parliament
https://ec.europa.eu/energy/sites/ener/files/documents/first_report_on_the_progress_of_implementation_of_the_radioactive_waste_and_spent_fuel_management_directive.pdf
https://ec.europa.eu/energy/sites/ener/files/documents/staff_working_document_progress_of_implementation_of_council_directive_201170euratom_swd2017_159_final.pdf
https://ec.europa.eu/energy/sites/ener/files/documents/staff_working_document_progress_of_implementation_of_council_directive_201170euratom_swd2017_161_final.pdf
- Member States to undertake self-assessment or **international peer review** periodically, at least every 10 years

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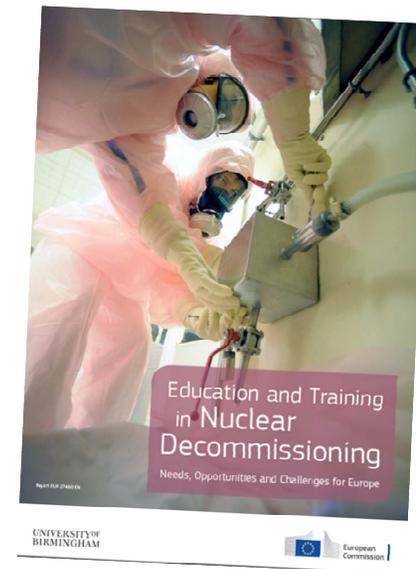
building competences

education and training in decommissioning

JRC organised jointly with the University of Birmingham in 2015 a seminar on Education and Training in Nuclear Decommissioning, in an attempt to answer to the questions:

- **What are the E&T needs ?**
 - **What are the opportunities, what does already exist ?**
 - **How can we attract young talent ?**
- Outcome of the seminar is published in a joint report with orientations on the way forward to support Education and Training in Nuclear Decommissioning in the EU.

<https://ec.europa.eu/jrc/en/publication/education-and-training-nuclear-decommissioning-needs-opportunities-and-challenges-europe>



how can we stimulate interest and future talent?

The JOB...

- 👎 'Breaking down' is not a very attractive occupation for me, I would prefer building something new!
- 👎 Why do I need to take care of the negative 'nuclear heritage' left by the others?
- 👎 At the end.. there is 'nothing'.
What will then happen with my job?



how can we stimulate interest and future talent?

The JOB...

- 👍 Decommissioning is in reality **much more** than clearing, cleaning and demolishing; decommissioning projects usually present an appealing technological challenge, requiring creative solutions.
- 👍 Decommissioning is an emerging activity involving on the average young people; related jobs offer many possibilities for **career development**.
- 👍 Decommissioning offers also tremendous opportunities for people who have developed expertise in reliable technologies or experience in managing projects and who are interested in **mobility**.
- 👍 A job in decommissioning is, in general, **secure**; young engineers and scientists graduating after studies dedicated to decommissioning are almost certain to find a job.
- 👍 Actually, decommissioning provides a service to society and can be considered as a '**noble cause**': decommissioning is aiming to restore a safe environment and demonstrates that closing the nuclear energy cycle is feasible.



European Learning Initiatives for Nuclear Decommissioning and Environmental Remediation

purpose of the ELINDER project:

Stimulate vocational training in nuclear decommissioning in the EU, by:

- creating a European 'pool of training initiatives' offering at different locations a series of courses, visits and practical studies;
- organised in complementing modules, reducing duplication;
- harmonizing and clarifying the learning outcomes;
- offering an EU 'quality label' or 'endorsement' to those initiatives contributing to qualitative competence building in decommissioning and waste management.

ELINDER project

Approach:

- Training modules of 1-2 weeks, at different locations
- Qualified '**Generic courses**' (G1-G5 General Introduction to Decommissioning) and '**Specific courses**':
 - S1 Decommissioning Planning and Cost Assessment
 - S2 Licensing and Environmental Impact Assessment
 - S3 Decommissioning Safety
 - S4 Decommissioning Programme and Project Management
 - S5 Waste and Material Management
 - S6 Decontamination and Dismantling Techniques
 - S7 Metrology for Waste Characterisation and Clearance
 - S8 Environmental Remediation and Site Release
- Complemented with '**e-Learning course**' (induction to nuclear)

examples of ELINDER courses (3)

JRC's Decommissioning Summer School

(ELINDER Generic course G5)

JRC-Ispra, 9-13 July 2018

- ❖ for Master students (with Bachelor degree, still studying) – max. 40
- ❖ mixture of lectures, practical exercises and visit
- ❖ lecturers from EC, IAEA and from seven EU MS
- ❖ concluded with a test
- ❖ mini 'job fair' (meeting with industry)
- ❖ repeated every year – next planned for **8-12 July 2019**

JRC's Decommissioning Summer School

(ELINDER Generic course G5)

JRC-Ispra, 9-13 July 2018



JRC's Decommissioning Summer School

(ELINDER Generic course G5)

JRC-Ispra, 9-13 July 2018



Invitation to the ELINDER course

Metrology for Radioactive Waste Characterisation and Clearance

16-20 September 2019 in Ispra, Italy

Programme overview

Monday 16.9

- Session 1: Introduction - Basic metrology
Rehearsal radiation measurement principles
- Session 2: Measurement methods for plant and waste characterisation, and for clearance

Tuesday 17.9 – Thursday 19.9

- Session 3: Introduction to 4 measurement techniques and practical exercises:
 - a. Gamma-ray spectrometry waste
 - b. Passive Neutron counting of waste
 - c. Gamma measurement for clearance
 - d. Destructive Analysis measurements for plant and waste characterisation

Friday 20.9

- Session 4: Validation of methods, inter-comparisons, standards, international networks
- Final session

Joint
Research
Centre



How to register?

If you are interested, mail your completed application form attached to the invitation to: JRC-DECOMM-Metrology@ec.europa.eu by the 31st July 2019 at the latest

For any questions, please contact Ivana Oceano
Tel. +32 (0) 229 91104

Location

JRC-Ispra
via Enrico Fermi 2749, Ispra, Italy
<https://goo.gl/maps/26uuW4dYkAG2>



European
Commission



SCK·CEN ACADEMY
FOR NUCLEAR SCIENCE AND TECHNOLOGY

About SCK·CEN
Academy

Customised training
courses for professionals

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Your thesis or internship

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Upcoming courses

Past courses

ELINDER S2 Training course | Decommissioning licensing and environmental impact assessment

Registration

October 21 - 25, 2019 Mol (BELGIUM)

Objective

Topics

Target audience

Programme

Language

Required knowledge

Learning outcomes

Price

Registration info

Accommodation

Contact & Venue

Activities related to the decommissioning of nuclear installations significantly differ from those performed during the operational period. The various actors (managers, engineers, technicians, health physicists, regulatory bodies, etc.) are faced with specific issues such as changing environments, numerous "one shot" operations, the production of huge amounts of waste, discrepancies between original design and the final layout of the facility, etc. The regulatory requirements and associated licensing procedure necessitate a good preparation for the dismantling strategy, safety assessment, risk management and environmental impact assessment. With the many questions emerging when a decommissioning project has to be set up, it is of utmost importance that the involvement of the stakeholders addresses the concerns of society.

The main objective of this training course is to provide the participants with the basic requirements regarding the licensing and environmental impact assessment of a decommissioning project and to share experience from ongoing decommissioning projects.

This course frames within the European [ELINDER project](#) (European Learning Initiatives for Nuclear decommissioning and Environmental Remediation).



ELINDER Project

Benefits from a joint EU approach:

- **Visibility and clarity:**

- possibility to **promote** the training by joint advertising to interested employers/trainees,
- enhanced clarity for the employers and interested trainees on the **outcomes and quality** of the anticipated training;

- **Synergies:**

- possibility **sharing** of courses, teachers or facilities to visit
- reducing organisational burden and maximising output using **common tools** and databases, including also IAEA tools, making the training more relevant and up-to-date
- maximising the use of the **expertise** available in each of the training organisations (particularly for the specific modules)

- **Increased opportunities:**

- possibility for trainees to **gradually** develop expertise by combining (over the years) different modules;
- possibility to integrate also **(funded) trainees** from third countries

ELINDER project

2019-2020

European Learning Initiatives
for Nuclear Decommissioning
and Environmental Remediation

version April 2019

catalogue and info:

<https://ec.europa.eu/jrc/en/training-programme/elinder>



ELINDER
CATALOGUE OF TRAINING COURSES

This document gives an overview of training courses on nuclear Decommissioning and Environmental remediation organized in the frame of the ELINDER project.

1. the context of nuclear decommissioning in Europe
2. the role of the European Union
3. radiation protection and decommissioning
- 4. conclusions**

conclusions

- Decommissioning market is expected to **expand, particularly in Europe**.
- Decommissioning will be a **long term activity** (until > 2050).
- Currently, industrial experience exists, good progresses are made, particularly with the decommissioning of reactors,
... however **further attention is necessary for:**
 - ✓ Development of the most suitable techniques, with respect to safety, efficiency and waste limitation;
 - ✓ Standardisation and harmonisation (incl. cost estimation);
 - ✓ Offering and promoting dedicated education and training opportunities;
 - ✓ Sharing knowledge and experiences.

why

***should we progress with nuclear
decommissioning?***



why should we progress with nuclear decommissioning?

- 1. respect of ethical and social principles**
- 2. optimisation of safety and environmental protection**
- 3. conformity with international regulation and agreements**
- 4. economical benefit**
- 5. societal confidence**



**thank you for
your attention**

