This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement nº 847626.

SHARE

A roadmap for research in Decommissioning

1-3 December 2020

Workshop will start at 9:00 CET

https://share-h2020.eu/
linkedin.share-h2020-project
linkedin/group SHARE Road map for Decommissioning

Please turn off your camera and put your micro on mute

cea — efficient innovation — enresa — IFE Institute for Energy Technology — European Commission Joint Research Centre — KIT Karlsruher Institut für Technologie — LEI — National Nuclear Laboratory — sckcen — SOGIN — VTT

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement nº 847626.

SHARE

A roadmap for research in Decommissioning

Welcome &
Objectives and agenda of the workshop
1-3 December 2020

https://share-h2020.eu/
linkedin.share-h2020-project
linkedin/group SHARE Road map for Decommissioning

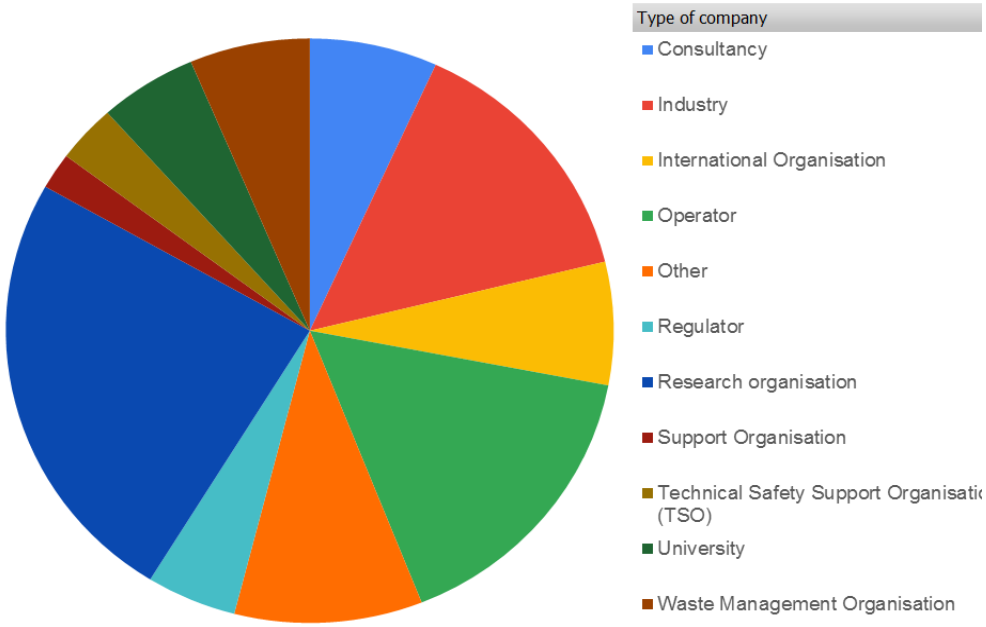
Christine GEORGES, CEA

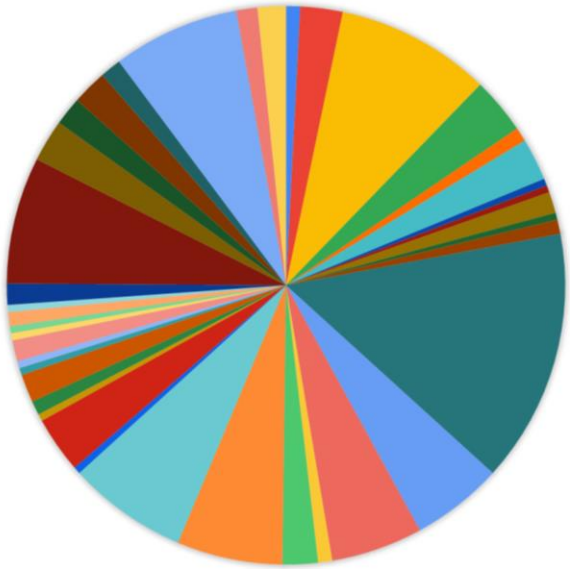
christine.georges@cea.fr

cea efficient innovation enresa IFE Institute for Energy Technology European Commission Joint Research Centre KIT Karlsruher Institut für Technologie LEI NATIONAL NUCLEAR LABORATORY sckcen SOGIN VTT

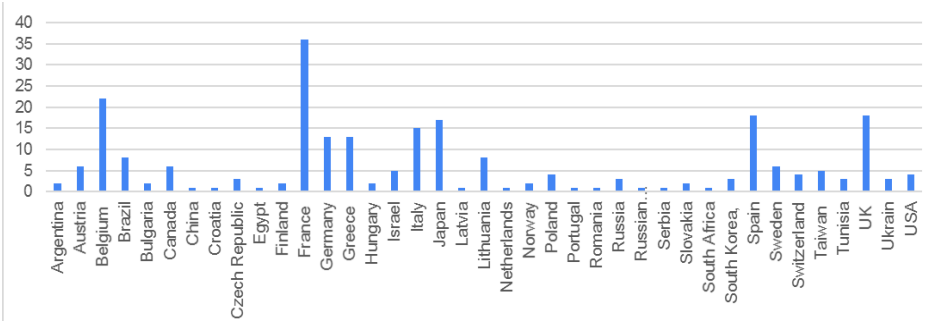
THANKS FOR ATTENDING THIS WORKSHOP

Great diversity and representativity of stakeholders interested





- more than 270 registered people
- from 150 entities
- from 39 countries



Special thanks to our colleagues from Asia and America who will get up very early or will work very late!

OBJECTIVES OF THE WORKSHOP

SHARE
A roadmap for research in Decommissioning

1. To get your feedback on the first results of the project:
   - ✓ thematic areas with needs for research*
   - ✓ first analysis of existing solutions and on-going developments
   - ✓ Methodology and schedule for next steps: gap analysis, SRA, Road Map

2. To coordinate with other international initiatives at EU, NEA, IAEA, etc. to avoid duplication

3. To share with you the investigation of needs and existing innovative solutions or on-going developments, as **we need your voices** to be able to conduct gap analysis and to provide, by the end of 2021, a strategic research agenda and a road map for potential future collaborative projects

(*): Research= R&D-I, Methodologies, Standardisation, etc. technical and non-technical

UPDATED PROGRAM WITH TEAMS AND MURAL LINKS

Sent by mail to registered people this morning + link in the chat

Dec 1st 9:00-13:40	introduction by EC Policy Officer and SHARE achievements at this stage
	Point of view of end users
	Examples of on-going international initiatives
	Explanation of logistics for break-out sessions

	Group A	Group B	Group C	Group D	Group E
Dec. 1st afternoon	① Safety and Radiological Protection	② Project Management and costing	④ Characterization	⑥ Dismantling technologies	⑧ Management of Waste
Dec. 2nd	⑦ Environmental remediation and Site Release	③ Human resources management			
Dec. 3d morning				⑤ Site preparatory activities	

Dec 3d 13:00 – 16:00	Restitution of work done in break out sessions + Q/As
	NEXT steps for SHARE and next events about decommissioning + conclusion of the workshop

This workshop is for you!

We tried to be innovative in the break-out sessions:

- Hope you can attend and enjoy it
- be patient if any bug as it is kind of prototype.

Don’t hesitate to comment and to tell us **what you really need or what you see as opportunities** so that Decommissioning and legacy waste management can be, in the future:

- Faster
- Cheaper
- Safer
- And …attractive for young generations

Results will depend on your active participation!

Euratom R&D Challenges and perspectives

Roger GARBIL
European Commission
DG Research and Innovation
Euratom Research
Head of the Fission sector
Roger.Garbil@ec.europa.eu

SHARE Decommissioning workshop, virtual meeting, 1-3 December 2020

Conferences' Proceedings FISA 2019 / EURADWASTE '19 … available!

Publications Office of the European Union

FISA 2019 Proceedings

https://op.europa.eu/en/publication-detail/-/publication/9cfc43f8-cbc7-11ea-adf7-01aa75ed71a1/language-en/format-PDF/source-140481060

EURADWASTE '19 Proceedings

https://op.europa.eu/en/publication-detail/-/publication/fe1b968b-cbc8-11ea-adf7-01aa75ed71a1/language-en/format-PDF/source-140505052

Keep in touch

- ec.europa.eu/
- europa.eu/
- @EU_Commission
- @EuropeanCommission
- European Commission
- europeancommission
- @EuropeanCommission
- EUTube
- EU Spotify

edp open

EPJ N Nuclear Sciences & Technologies

EPJ N Topical issues https://www.epj-n.org/

- **TOPICAL Edition** https://www.epj-n.org/component/toc/?task=topic&id=1234
- **AWARDS Selection** https://www.epj-n.org/component/toc/?task=topic&id=1169

romania2019.eu

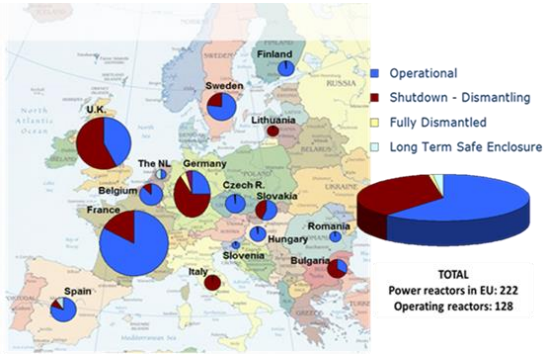
Romanian Presidency of the Council of the EU in 2019 Conferences http://fisa-euradwaste2019.nuclear.ro/

FISA 2019 Presentations http://fisa-euradwaste2019.nuclear.ro/fisa/

EURADWASTE '19 Presentations http://fisa-euradwaste2019.nuclear.ro/euradwaste/

CHALLENGES AND ECONOMICAL STAKES IN DECOMMISSIONING

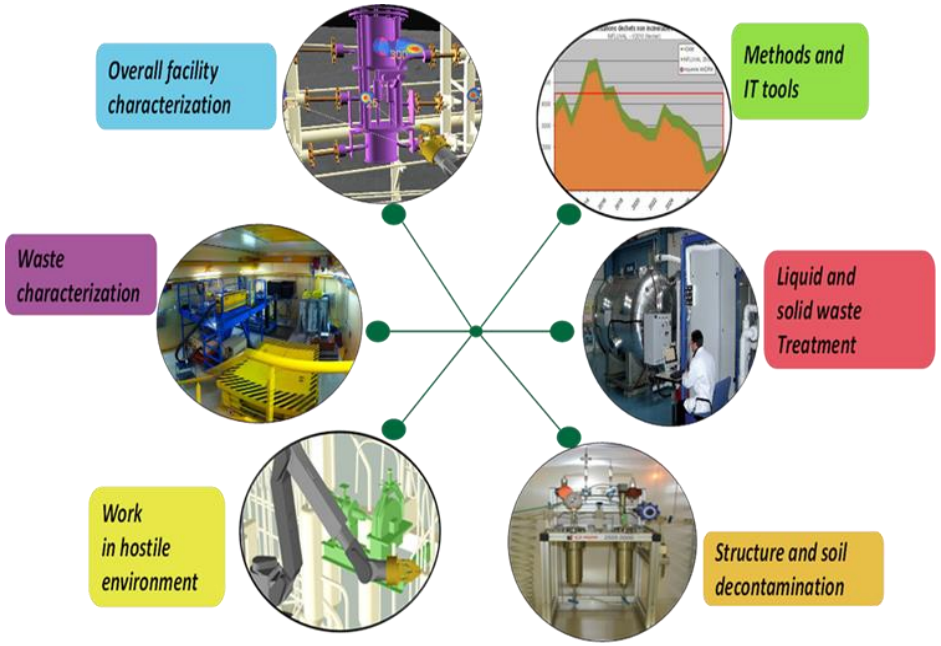
A certain level of industrial maturity for Decommissioning of rather 'standard' nuclear facilities relying mostly upon proven processes and technologies, e.g. for PWR



➡ **Need to build on these : methodology and even standardization wherever + few possibilities of optimization/ cost reduction (digital tools, laser cutting, waste routes, etc)**

But still a number of technological challenges for the decommissioning industry, eg. graphite reactors, fuel cycle back end facilities or other legacy waste

➡ **Need to accelerate projects in order to decrease fixed costs**
Need for research targeted to the actual needs of end users, in a "waste- led approach"



Also, non-technological issues, e.g need to stimulate young generation on the necessary competences

➡ **Education and training, Competence maintenance, Project management, Contracting, Dialogue with society, regulators, etc.**

European Commission

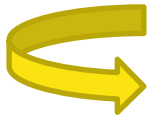
Context in 2016 – EU added-value for Decommissioning R&D

On one hand:

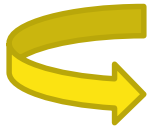
- Increasing difficulties for Individual countries to justify expenditures on new developments that can require more than 10 years to be completed
- Reluctance on sites to use innovative technologies and search for approved technologies to minimize risks
- Industrials need confidence in markets and associated business plans before investing in industrialization.

On the other hand

- Significant redundancy and duplication in current Research programmes for Decommissioning in different countries
- Already lot of cooperation (IAEA, NEA, etc.) , but… few real projects in common in 2016



More impulse needed to develop and to use research and innovation in Decommissioning projects and to promote and organize at international level the co-financing of developments and demonstrators by actors with common objectives



Euratom research and training programme H2020 NFRP-2018-5: coordination and Support Action to the European Commission "Development of a roadmap for decommissioning research aiming at safety improvement, environmental impact minimisation and cost reduction"

European Commission

Great Impulse given by EC for Decommissioning from 2016

Horizon 2020 - Euratom (2014 - 2018) | Extension (2019-2020)

WP 2014 / 2015	WP 2016 / 2017	WP 2018	WP 2019 / 2020
Projects - started mid-2015	Projects - started mid-2017	Started mid-2019	Started mid-2020
Geological Disposal *(IGD-TP priorities)*	**GD - HLW/SF** *(IGD-TP priorities)*	**RWM**	
CEBAMA - Cement / rock & bentonite interactions	**DISCO** - Modern SF disso. & charact.	**EURAD** - European Joint Programme on Radioactive Waste Management	
Modern2020 - *Repository monitoring strategy & tech*	**Beacon** - Bentonite Mech. Evolution		
MIND - Microbiology in repositories			
	Predisposal - Other wastes		**Predisposal**
TSO support	CHANCE - Charact. of conditioned waste		PREDIS - Predisposal management of radioactive waste
SITEX II - Structure TSO community for safety case reviews	THERAMIN - Thermal treatment for waste mini.		
Preparatory phase for Joint Programme	**Dismantling / Decommissioning** (D&D)	**D&D**	**D&D**
JOPRAD - Prepare for European Joint Programme	**INSIDER** - Charact. for waste mini. in Decom. & Dism.	**SHARE** - R&D Roadmap	**CLEAN-DEM** Digital Robotics
			INNO4GRAPH Graphite
E&T + Social Science & Humanities	**E&T**	**MICADO** - Instrumentation for characterisation	**LD-SAFE** - Laser technologies
ANNETTE - Euro Master & vocational E&T Prog. in Nuc. Science & Technology	**MEET-CINCH** - Radiochemistry teaching		**PLEIADES** - Digital D&D planning software module platform
HoNEST - History of factors influencing successes and failures of nuc. energy developments	**ENENplus** - Post academic educ. & mobility scheme		

Total EU funding, Horizon 2020, in RWM = € 99.5 million

Disposal – HLW / SF:	€ 56.59 million
Predisposal:	€ 21.88 million
Dismantling / Decommissioning:	€ 21.03 million

Other funding, horizontal activities

E&T + Social Science & Humanities: € 10.66 million

European Commission

Current EU projects important for Decommissioning

Characterization (In situ / facility and waste)

NSIDER

CHANCE
Characterization of Conditioned Nuclear Waste for its Safe Disposal in Europe

micado

EMPIR EURAMET

CLEANDEM

Dismantling technologies

LD SAFE

INNO4GRAPH

PLEIADES
Smarter Plant Decommissioning

RIMA
ROBOTICS FOR INSPECTION AND MAINTENANCE

Management of waste

TRANSAT
TRANSversal Actions for Tritium

theramin

ROUTES eurad
European Joint Programme on Radioactive Waste Management

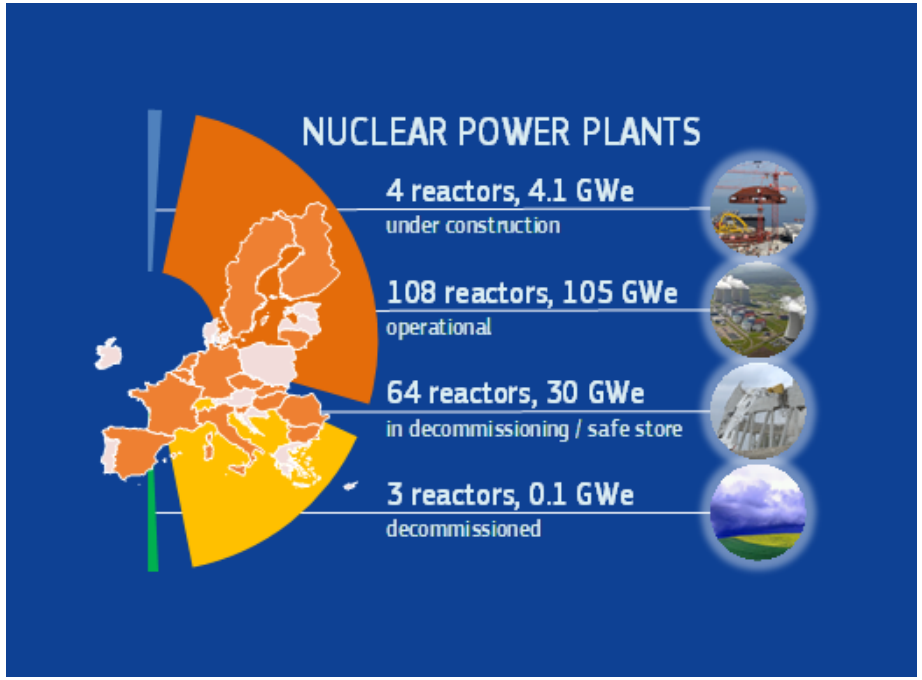
PREDIS

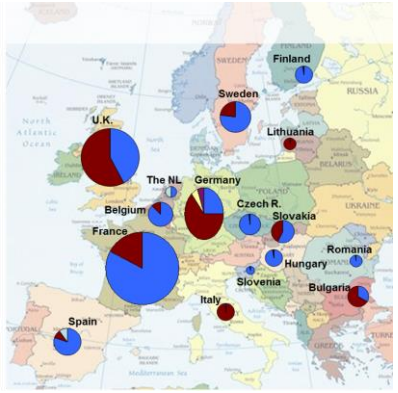
European Commission

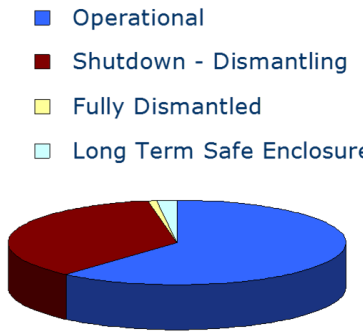
Nuclear Decommissioning Market and complementing R&D

Activities have increased and will further grow in the European Union

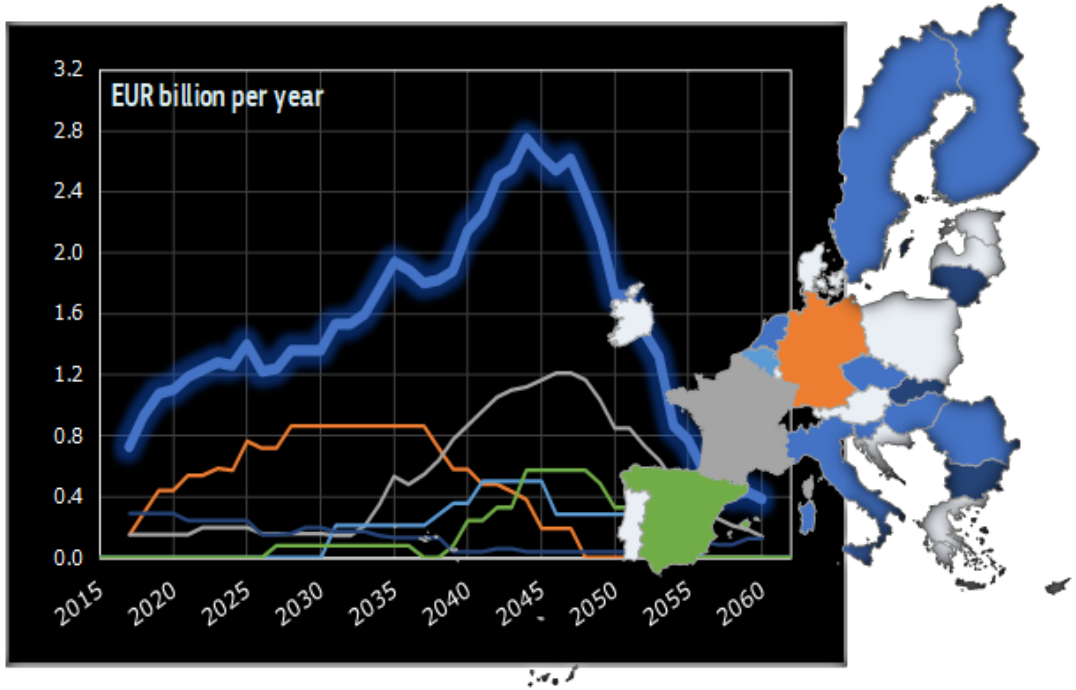
The total projected expenditures in decommissioning in the EU until 2060 are estimated at ~EUR 65 billion







TOTAL
Power reactors in EU: 222
Operating reactors: 128



DG ENER STUDY Market for decommissioning nuclear facilities - 09/10/2019
https://op.europa.eu/en/publication-detail/-/publication/2bf03904-ebf1-11e9-9c4e-01aa75ed71a1/language-en/format-PDF/source-110955267

European Commission

Radioactive Waste Management and Geological Disposal

A group of forerunners, also on a global scale, precedes by several decades the others

2nd Radioactive Waste Directive Implementation Progress Report EC / MS

COM(2019) 632 https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2019:0632:FIN
SWD(2019) 435 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019SC0435
SWD(2019) 436 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52019SC0436

European Commission

R&D Strategic studies Knowledge management Interacting with Civil Society

eurad
European Joint Programme
on Radioactive Waste Management

EURAD General Assembly

EURAD General Assembly

March 2021

igd·tp
safe solutions for radioactive waste

EURAD **https://www.ejp-eurad.eu/**

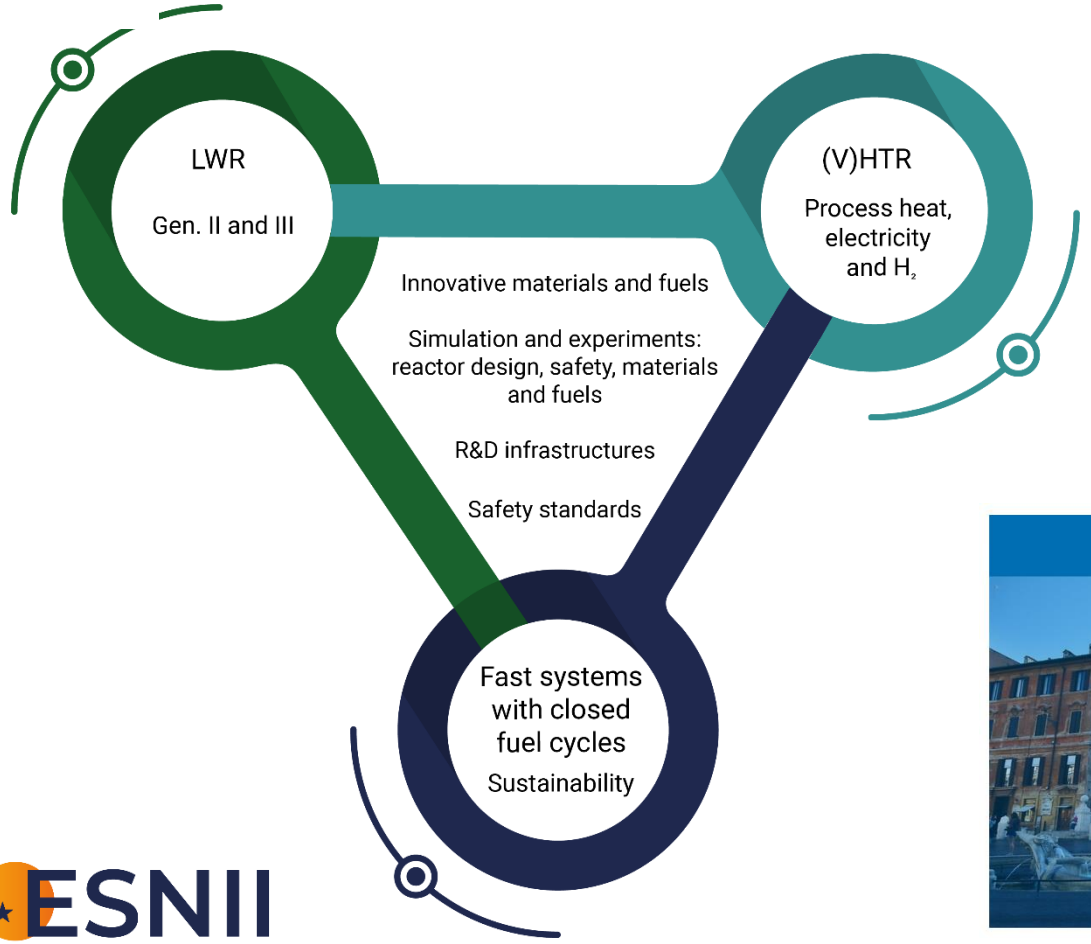
IGDTP **https://igdtp.eu/**

European Commission

SNETP
Sustainable Nuclear Energy Technology Platform

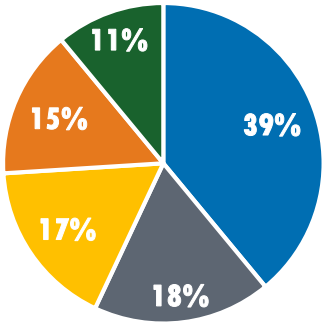
June 2019: SNETP Evolution towards a legal entity

NUGENIA
Nuclear Generation II&III Alliance



NC2I
Nuclear Cogeneration Industrial Initiative

Categories of membership (120 members)



- Research organisations
- Industry
- SMEs
- Academia
- Other

Networking

ESNII
European Sustainable Nuclear Industrial Initiative

European Commission

Perspectives

- Euratom experience with FP is **a consistent success in pursuing excellence** in nuclear science research and technology
- **Close collaboration between** EC, MSs, OECD/NEA and IAEA, GIF, International Frameworks agreements
- **Stakeholders structured dialogue** on R&D policy, safety improvements, holistic approach and early involvement in decision making
- **Industry driven ETPs, Fora** are being capitalised

NEA Nuclear Energy Agency

IAEA.org International Atomic Energy Agency

SNETP Sustainable Nuclear Energy Technology Platform

GEN IV International Forum

igd·tp safe solutions for radioactive waste

eurad European Joint Programme on Radioactive Waste Management

enen european nuclear education network

eTP European Technology Platforms

European Commission

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement nº 847626.

SHARE

A roadmap for research in Decommissioning

General presentation of the project EU-H2020- SHARE Decommissioning

1-3 December 2020

https://share-h2020.eu/
linkedin.share-h2020-project
linkedin/group SHARE Road map for Decommissioning

Christine GEORGES, CEA

christine.georges@cea.fr

cea efficient innovation enresa IFE Institute for Energy Technology European Commission Joint Research Centre KIT Karlsruher Institut für Technologie LEI NATIONAL NUCLEAR LABORATORY sckcen SOGIN VTT

«SHARE » = StakeHolders-based Analysis of Research* for Decommissioning

June 2019 / November 2021

Forerunner of a framework to enhance International collaborative projects on Research activities related to Decommissioning

Stakeholder's Needs

Current Available Solutions

Questionnaire

Open Online Consultations

Gap Analysis

Strategic Research Agenda (SRA)

SRA

Strengths
Reduced Costs
Automated
TRL

Weaknesses
Insufficient funds
Waste production
No demonstration

Opportunities
Added value
Knowledge management access
Sharing costs

Threats
Public acceptance
Regulation changes
Waste disposal routes

Roadmap

(*): “Research”= R&D, R&I, methodologies, standardization, etc. in technical and non technical areas

Project focused on a the wide Decommissioning community

SHARE
A roadmap for research in Decommissioning

All along the value chain

CONSORTIUM

enresa

European Commission
Joint Research Centre

cea

NATIONAL NUCLEAR LABORATORY

SCK·CEN

Expert Review Panel

TÜV NORD

IAEA
International Atomic Energy Agency

NEA
Nuclear Energy Agency

IRSN

EDF

In Extenso
Innovation Croissance

SOGIN

IFE

DTU

ENGIE

KIT
Karlsruher Institut für Technologie

ANDRA

ichtj

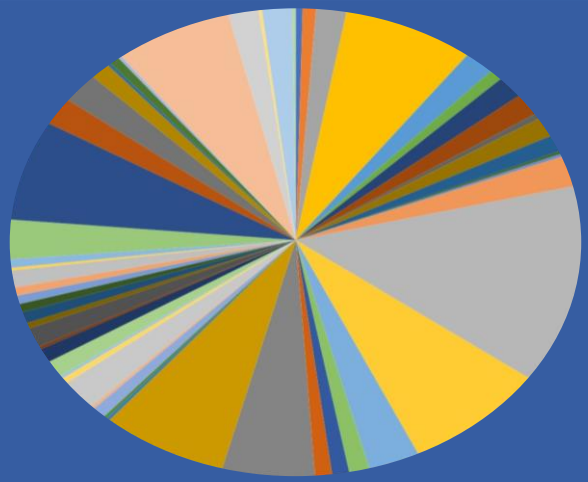
VTT

tvo

PAUL SCHERRER INSTITUT
PSI

SWECO

NUCLEAR RESEARCH INSTITUTE
ÚJV



500 people from 57 countries either answered to the survey either registered to the present workshop (60 both)

ENERGORISK

SSTC NRS

EPRI

KAERI

JAEA

CRIEPI

POINT OF SITUATION

December 2020

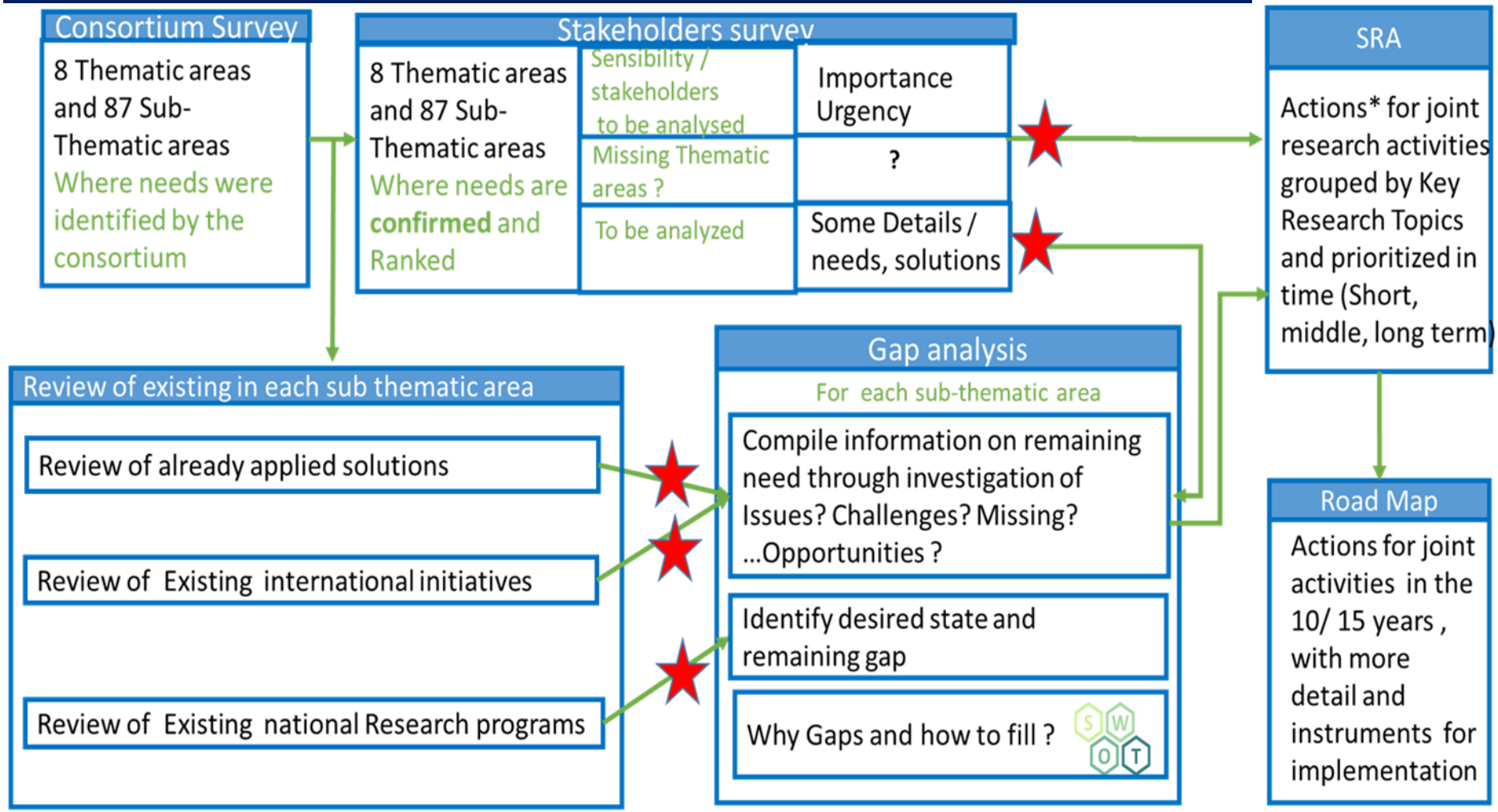
- Survey among 600 stakeholders during Summer 2020: asked to rank importance and urgency of their needs for Research, aiming at improving Safety, costs and optimizing Waste in Decommissioning

- 230 responses under final analysis

- In parallel, report on best practices and on-going international initiatives under review

- Starting of gap analysis

INVESTIGATIONS EXPECTED DURING THE WORKSHOP



(*): for non-technological issues, actions may be organised as cross-cutting activities (e.g. maintaining sustainable competence, education and training, dialogue with regulators, etc.)

NEED TO COORDINATE WITH OTHER INTERNATIONAL INITIATIVES

To avoid duplication of work

European Commission

SHARE
A roadmap for research in Decommissioning

1 Safety and Radiological Protection

ETSON EUROPEAN TECHNICAL SAFETY ORGANISATIONS NETWORK

SHARE
Social sciences and Humanities in ionising radiation REsearch

7 Environmental remediation and Site Release

IAEA International Atomic Energy Agency

NEA Nuclear Energy Agency

2 Project Management and costing

IAEA International Atomic Energy Agency

NEA Nuclear Energy Agency

3 Human resources management

ELINDER European Learning Initiatives for Nuclear Decommissioning and Environmental Remediation

enen+

4 Characterization

NSIDER

CHANCE
Characterization of Conditioned Nuclear Waste for its Safe Disposal in Europe

micado

EMPIR EURAMET

CLEANDEM

IAEA International Atomic Energy Agency

NEA Nuclear Energy Agency

6 Dismantling technologies

LD SAFE

INNO4GRAPH

PLEIADES
Smarter Plant Decommissioning

RIMA
ROBOTICS FOR INSPECTION AND MAINTENANCE

5 Site preparatory activities

8 Management of Waste

TRANSAT
TRANSversal Actions for Tritium

theramin

ROUTES eurad
European Joint Programme on Radioactive Waste Management

PREDIS

IAEA International Atomic Energy Agency

NEA Nuclear Energy Agency

European Commission

IAEA International Atomic Energy Agency

NEA Nuclear Energy Agency

WORLD NUCLEAR ASSOCIATION

FORATOM

SNETP
Sustainable Nuclear Energy Technology Platform

NDF

EPRI

CANDU Owners Group Inc.
COG
"Excellence Through Collaboration"

NEXT STEPS

- End of Gap Analysis, SRA and Roadmap Nov.2021
- 2 other worshops of the project in 2021 hopefully face to face …

2021	2-3/02			SNETP forum
	8-12/03			Waste Management
	17-19/03	Germany	Dresden	KONTEC 2021
	23-25/03	Norway	Halden	Digidecom
	18-21/05	China	Beijing	NEA-China Forum on Decom. & RWMC
	7-9 / 06	France	Avignon	DEM 2021
	06	France	Marcoule	NEA CPD meeting
	06	France	Marcoule	IDN meeting
	30/09-10	France	Cadarache	Congress of ATSR

And much more to be followed through emails and medias!

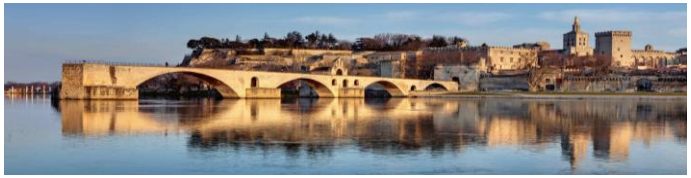
www.ife.no/digidecom-elinder-2020
www.ife.no/digidecom2021

SFEN
www.sfen-dem2021

DEM 2021,

Palais des Papes - Avignon, France

Call for abstracts !



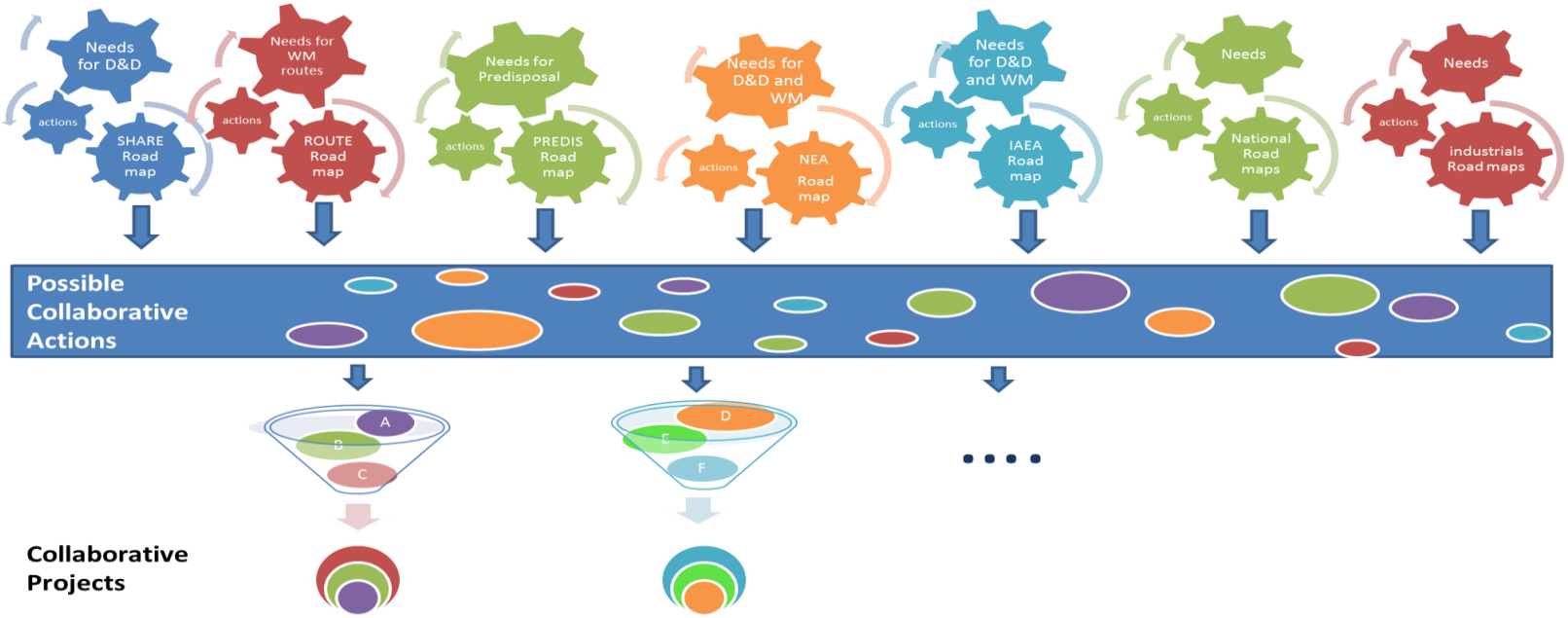
https://www.sfen-dem2021.org/

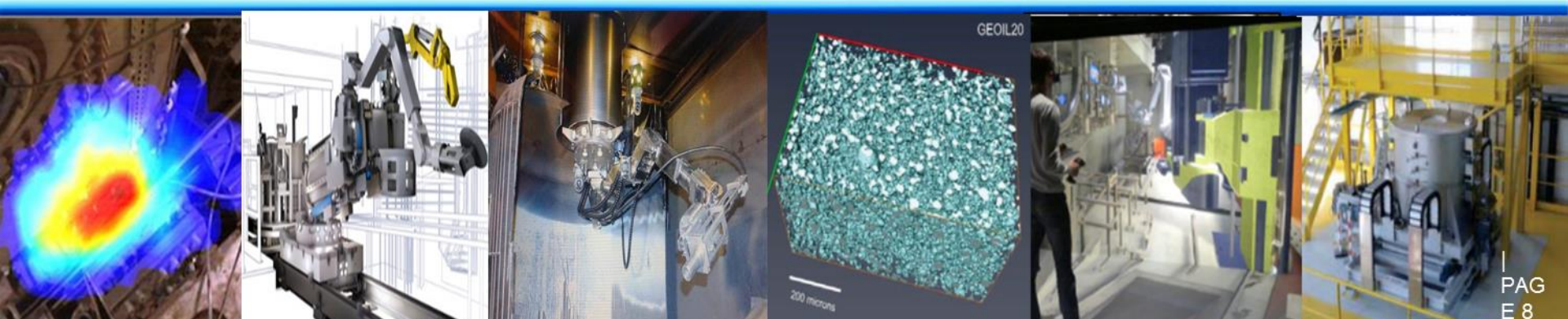
linkedin/group SHARE Road map for Decommissioning
https://share-h2020.eu/
linkedin.share-h2020-project

Thanks for your attention
Hope you have a nice workshop!

SHARE

A roadmap for research in Decommissioning





Work Package 2:

Preliminary results from survey on needs for Research

Jorge Borque Liñán, Emilio Garcia Neri
ENRESA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement nº 847626.

Work Package 2

Context: Objective

Aimed to produce a neutral, balanced and reliable assessment of the opinions collected from the stakeholders referred to research needs for decommissioning

- Prepare questionnaire
- Collect data with web supported tool
- Use of assessment criteria
- Quantitative and qualitative analysis

To rank identified innovation needs and compare with available solutions (cf. WP 3) for doing a Gap Analysis

→ STRATEGIC RESEARCH AGENDA → ROADMAP

Define and prioritize research and innovation activities in the field of decommissioning, with tentative schedule and potential actors

Work Package 2

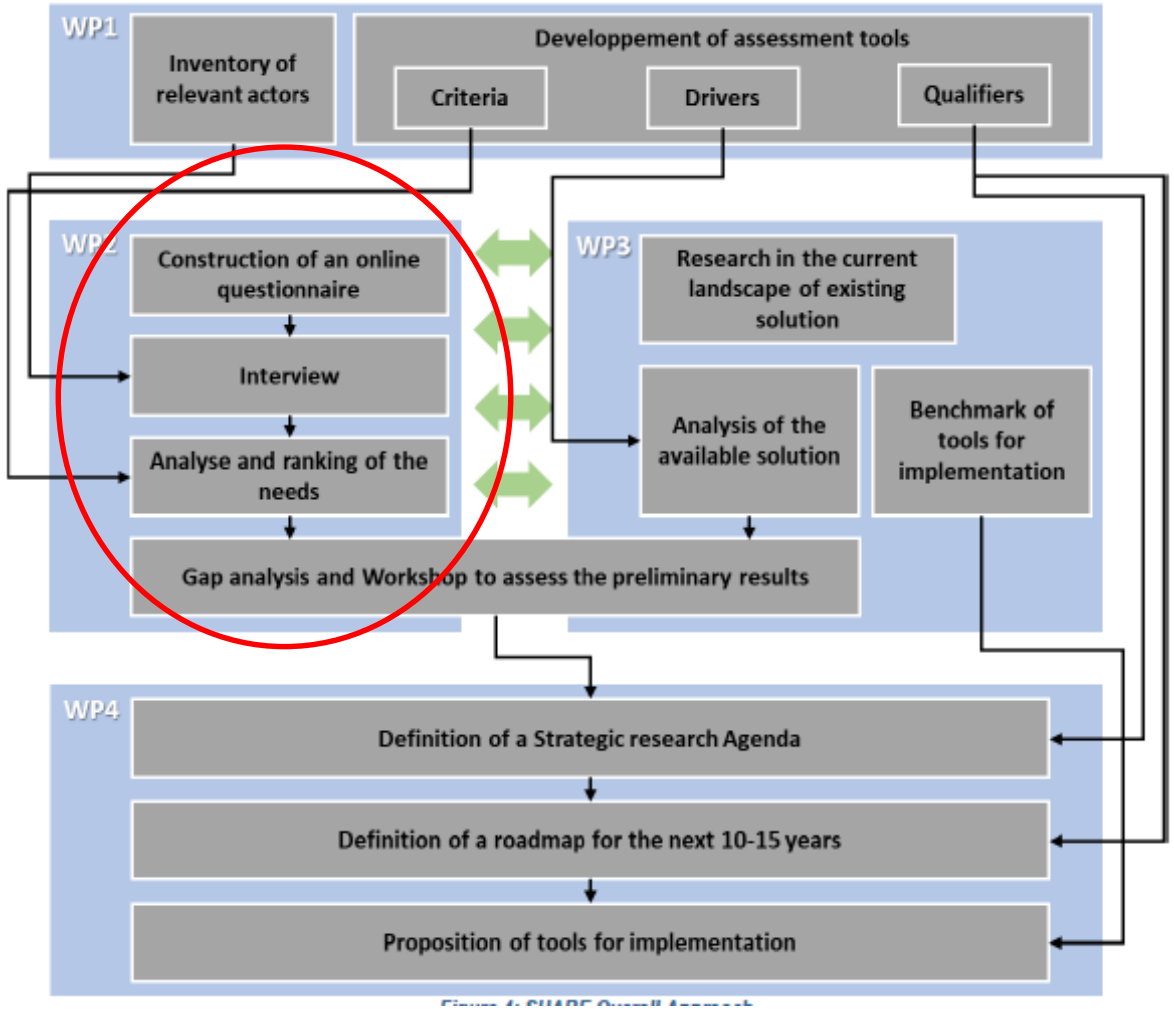
Scope and organization Objective

WP2 is composed by three tasks:

2.1 Building the questionaire

2.2. Interviews to relevant stakeholders

2.3. Assessment and exploitation of results.



STAKEHOLDERS PARTICIPATION

Main differences respect preceding exercises:

- Covering any interested stakeholder

Profile/Mapping

- Institutional position beyond expert opinion

Network

- Survey as key source of information

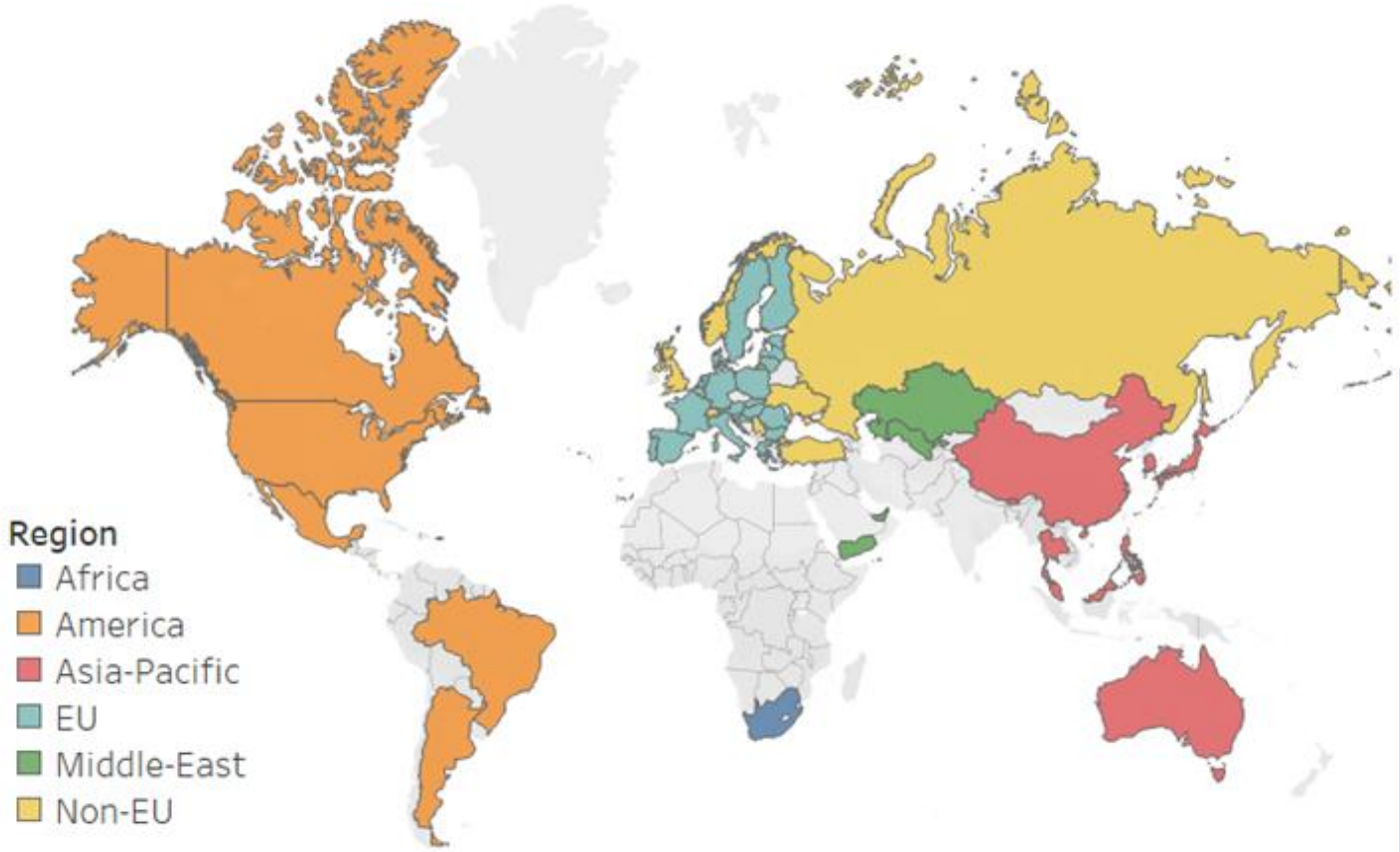
PROFILE
- Country
- Type of organization
- Number of employees
- Status on decom. projects
- Type of Facility

THE QUESTIONNAIRE

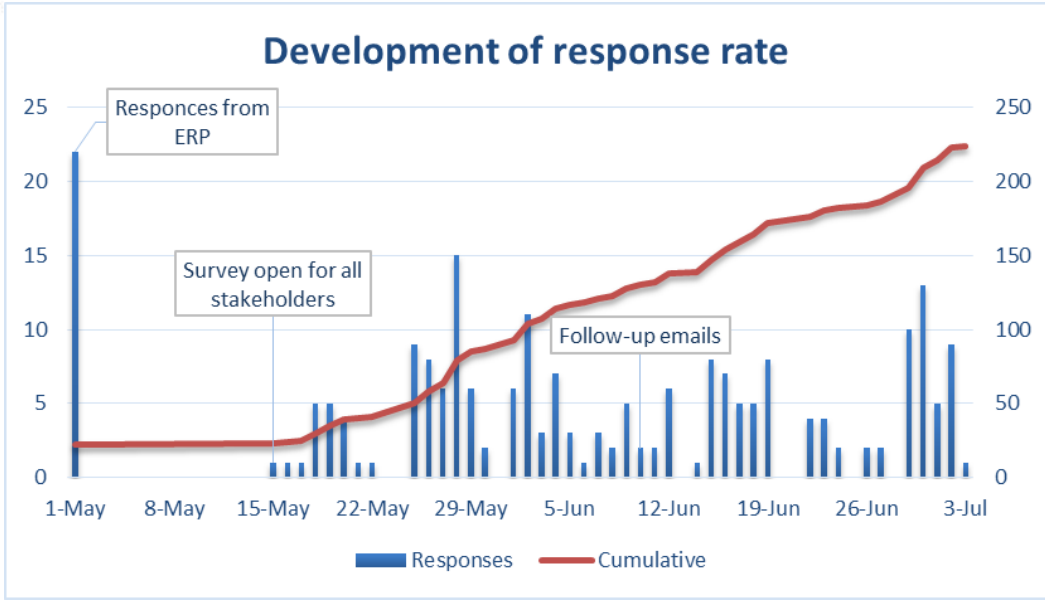
TOPICS
GENERAL OVERVIEW (9)
SAFETY AND RADIOLOGICAL PROTECTION ASPECTS (9)
PROJECT MANAGEMENT AND COSTING (11)
HUMAN RESOURCES MANAGEMENT (5)
CHARACTERIZATION DURING DECOMMISSIONING (12)
SITE PREPARATORY ACTIVITIES (4)
DISMANTLING (11)
ENVIRONMENTAL REMEDIATION AND SITE RELEASE (8)
MANAGEMENT OF MATERIALS AND RADIOACTIVE WASTES FROM DECOMMISSIONING (22)

QUESTIONNAIRE
- 82 sub-topics
- 9 open questions

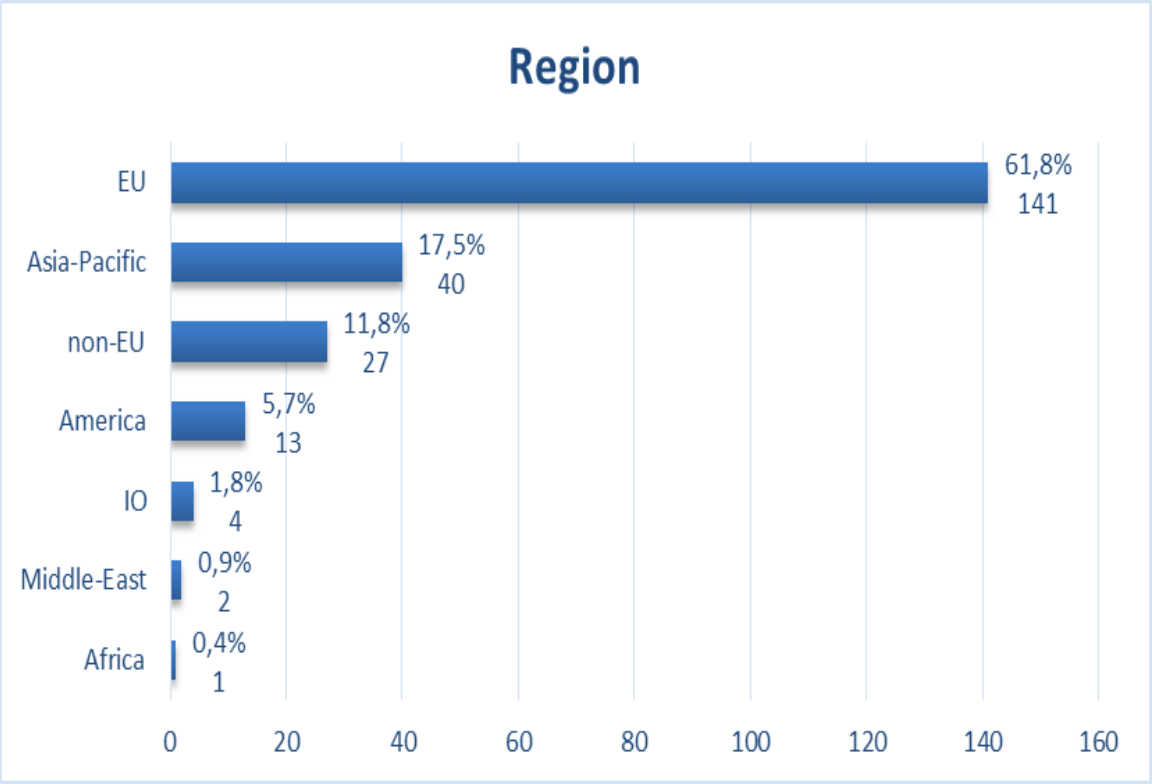
SURVEY RESPONDENTS



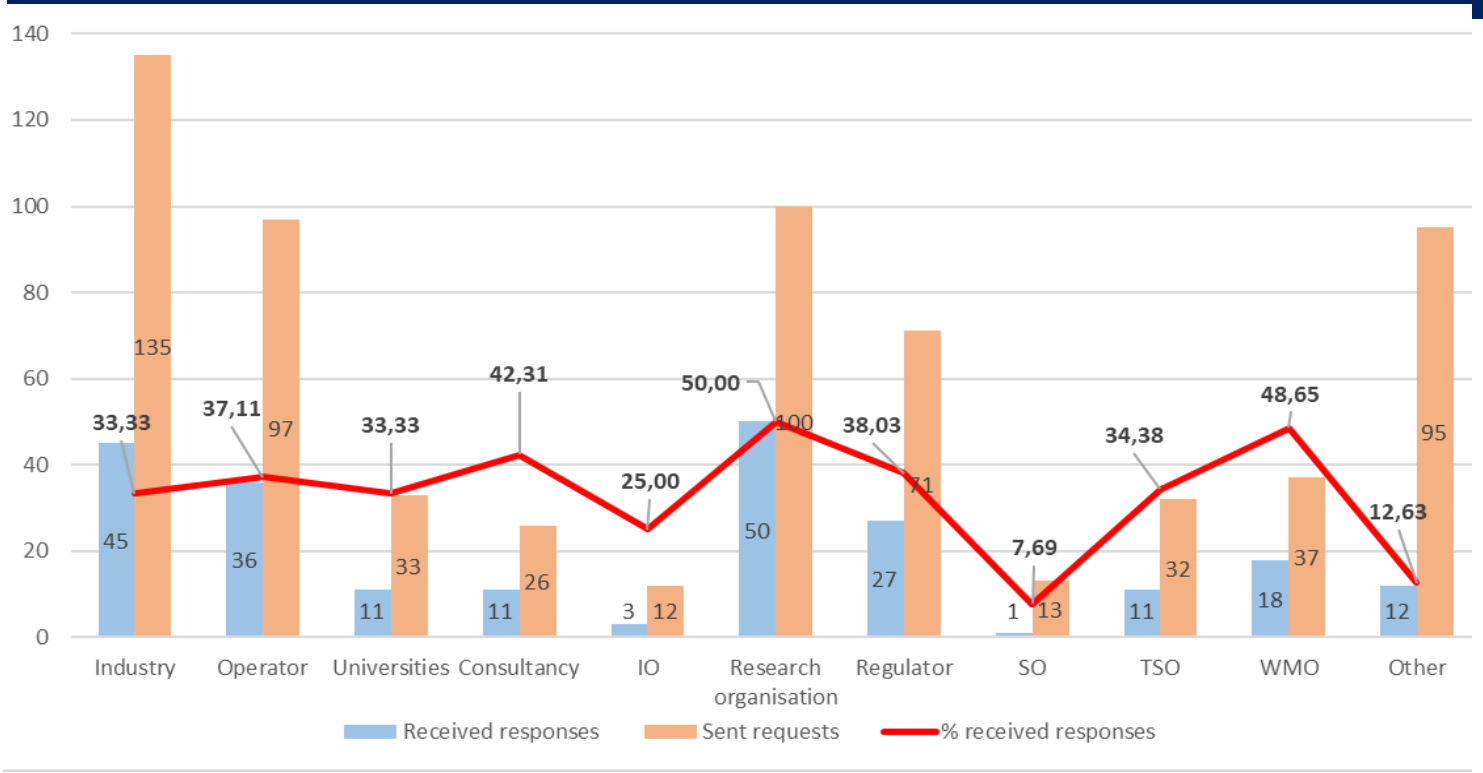
- 650 contacts
- 224 complete responses



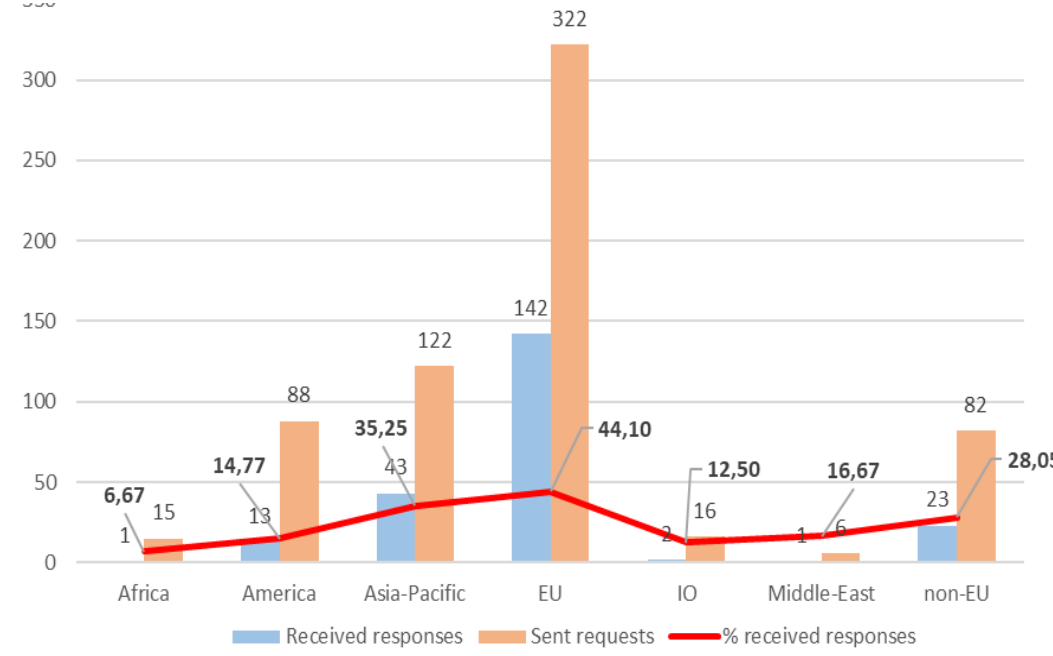
SURVEY RESPONDENTS



RESPONSES DESCRIPTION



Type of stakeholders



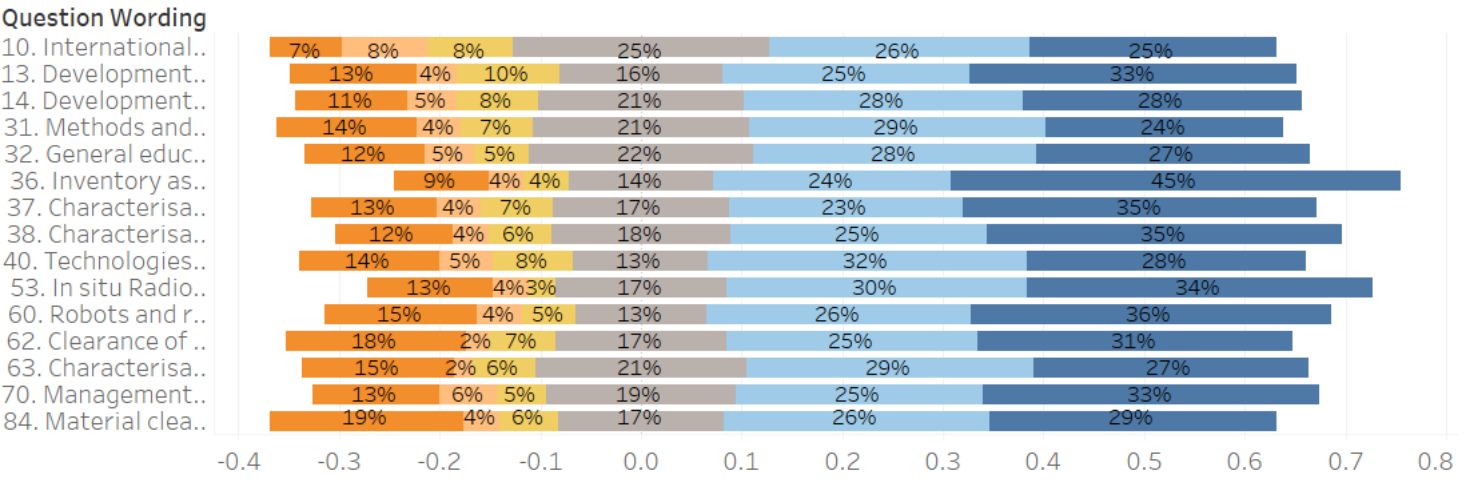
Regions

IMPORTANCE

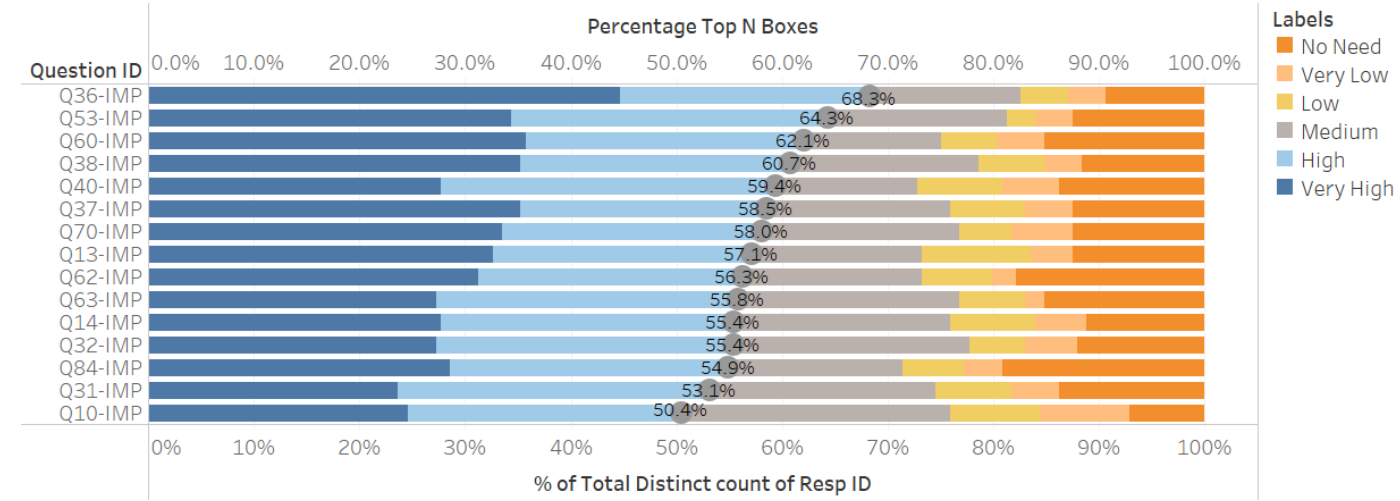
TOP SCORED SUBTOPICS	SCORING
36 - INVENTORY ASSESMENT (RADIOLOGICAL AND NON RADIOLOGICAL)	836
53 - IN SITU RADIOACTIVE WASTE CHARACTERIZATION	787
38 - CHARACTERIZATION OF ACTIVATED COMPONENTS AND AREAS (CONCRETE)	779
37 - CHARACTERIZATION OF ACTIVATED COMPONENTS AND AREAS (METAL)	762
60 - ROBOTS AND REMOTE CONTROL TOOLS FOR DISMANTLING	757
70 - MANAGEMENT ROUTES FOR MATERIALS INCLUDING RADIOACTIVE WASTE STREAMS	756
13 - DEVELOPMENT FOR NATIONAL REGULATORY GUIDANCE FOR DECOMMISSIONING (CLEARANCE OF STRUCTURES AND MATERIALS)	748
14 - DEVELOPMENT FOR NATIONAL REGULATORY GUIDANCE FOR DECOMMISSIONING (FINAL SITE RELEASE)	743
32 - GENERAL EDUCATION FOR DECOMMISSIONING	742
63 – CHARACTERIZATION METHODS AND TECHNOLOGIES TO IDENTIFY SUBURFACE CONTAMINATION	734
40 - TECHNOLOGIES FOR HARD TO ACCESS AREAS	732
62 – CLEARANCE OF SURFACES AND STRUCTURES (INTERIOR AND EXTERIOR)	723

IMPORTANCE

Likert Scale Questions using Divergent Stacked Bar Chart Importance



Likert Scale with Percent Top N Boxes Importance Most Highly Scored



36 - INVENTORY ASSESMENT (RAD. AND NON RADIOLOGICAL)
53 - IN SITU RADIOACTIVE WASTE CHARACTERIZATION
38 - CHARACTERIZATION OF ACTIVATED COMPONNETS (CONCRETE)
37 - CHARACTERIZATION OF ACTIVATED COMPONENTS (METAL)
60 - ROBOTS AND REMOTE CONTROL TOOLS FOR DISMANTLING
70 - MANAGEMENT ROUTES FOR MATERIALS INCLUDING RAD. WASTE STREAMS
13 - DEVELOPMENT FOR NATIONAL REGULATORY GUIDANCE FOR DECOMMISSIONING (CLEARANCE OF STRUCTURES AND MATERIALS)
14 - DEVELOPMENT FOR NATIONAL REGULATORY GUIDANCE FOR DECOMMISSIONING (FINAL SITE RELEASE)
32 - GENERAL EDUCATION FOR DECOMMISSIONING
63 – CHARACTERIZATION METHODS AND TECHNOLOGIES TO IDENTIFY SUBURFACE CONTAMINATION
40 - TECHNOLOGIES FOR HARD TO ACCESS AREAS
62 – CLEARANCE OF SURFACES AND STRUCTURES (INTERIOR AND EXTERIOR)

URGENCY

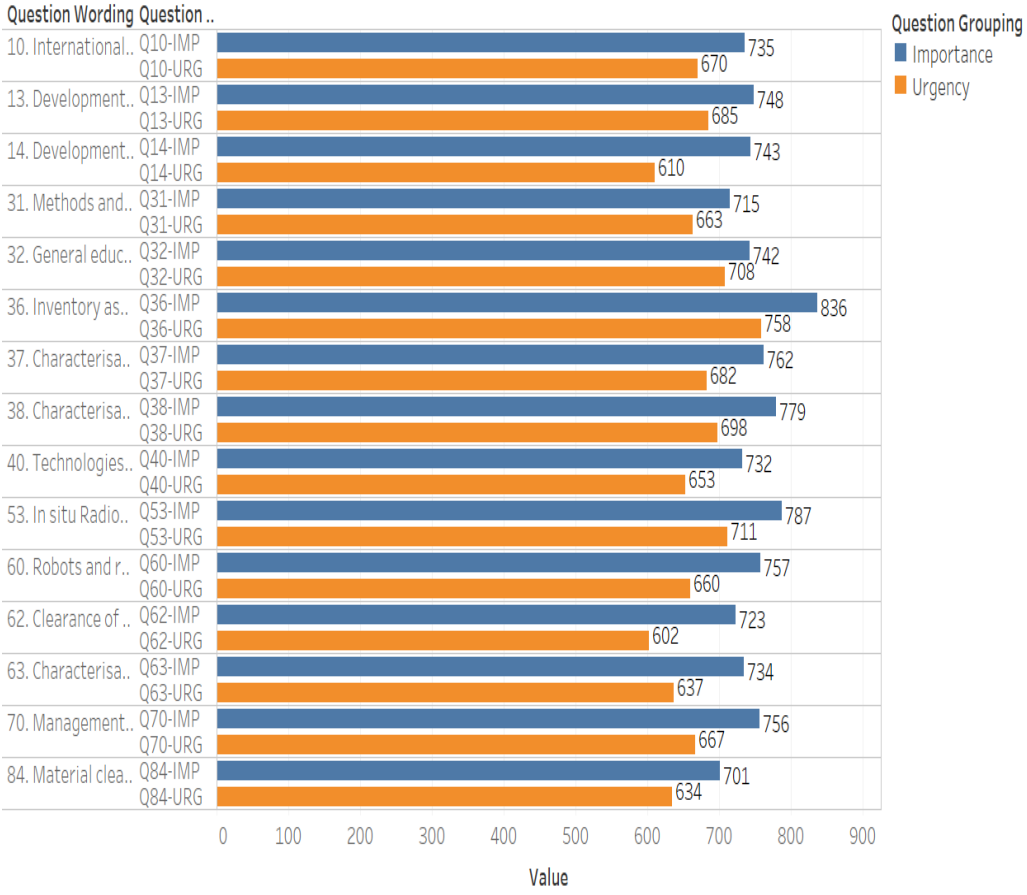
TOP SCORED SUBTOPICS	SCORING
36 - INVENTORY ASSESMENT (RADIOLOGICAL AND NON RADIOLOGICAL)	758
53 - IN SITU RADIOACTIVE WASTE CHARACTERIZATION	711
32 - GENERAL EDUCATION FOR DECOMMISSIONING	708
38 - CHARACTERIZATION OF ACTIVATED COMPONENTS AND AREAS (CONCRETE)	698
13 - DEVELOPMENT FOR NATIONAL REGULATORY GUIDANCE FOR DECOMMISSIONING (CLEARANCE OF STRUCTURES AND MATERIALS)	685
37 - CHARACTERIZATION OF ACTIVATED COMPONENTS AND AREAS (METAL)	682
10 - INTERNATIONAL HARMONIZATION OF SAFETY STANDARDS AND SAFETY APPROACHES FOR DECOMMISSIONING	670
70 - MANAGEMENT ROUTES FOR MATERIALS INCLUDING RADIOACTIVE WASTE STREAMS	667
31 –METHODS AND SOFTWARE TOOLS FOR KNOWLEDGE MANAGEMENT (E.G. COMPETENCE PRESERVATION)	663
60 - ROBOTS AND REMOTE CONTROL TOOLS FOR DISMANTLING	660
40 - TECHNOLOGIES FOR HARD TO ACCESS AREAS	653
84 - MATERIAL CLEARANCE (METHODOLOGY AND PROCEDURES)	634

IMPORTANCE + URGENCY

SHARE
A roadmap for research in Decommissioning

TOP SCORED SUBTOPICS

36 - INVENTORY ASSESMENT (RADIOLOGICAL AND NON RADIOLOGICAL)
53 - IN SITU RADIOACTIVE WASTE CHARACTERIZATION
38 - CHARACTERIZATION OF ACTIVATED COMPONENTS AND AREAS (CONCRETE)
32 - GENERAL EDUCATION FOR DECOMMISSIONING
37 - CHARACTERIZATION OF ACTIVATED COMPONENTS AND AREAS (METAL)
13 - DEVELOPMENT FOR NATIONAL REGULATORY GUIDANCE FOR CLEARANCE (STRUCTURES AND MATERIALS)
70 - MANAGEMENT ROUTES FOR MATERIALS INCLUDING RADIOACTIVE WASTE STREAMS
60 - ROBOTS AND REMOTE CONTROL TOOLS FOR DISMANTLING
10 - INTERNATIONAL HARMONIZATION OF SAFETY STANDARDS AND SAFETY APPROACHES FOR DECOMMISSIONING
40 - TECHNOLOGIES FOR HARD TO ACCESS AREAS
31 –METHODS AND SOFTWARE TOOLS FOR KNOWLEDGE MANAGEMENT (E.G. COMPETENCE PRESERVATION)
63 – CHARACTERIZATION METHODS AND TECHNOLOGIES TO IDENTIFY SUBURFACE CONTAMINATION
14 - DEVELOPMENT FOR NATIONAL REGULATORY GUIDANCE FOR DECOMMISSIONING (FINAL SITE RELEASE)
84 - MATERIAL CLEARANCE (METHODOLOGY AND PROCEDURES)
62 – CLEARANCE OF SURFACES AND STRUCTURES (INTERIOR AND EXTERIOR)

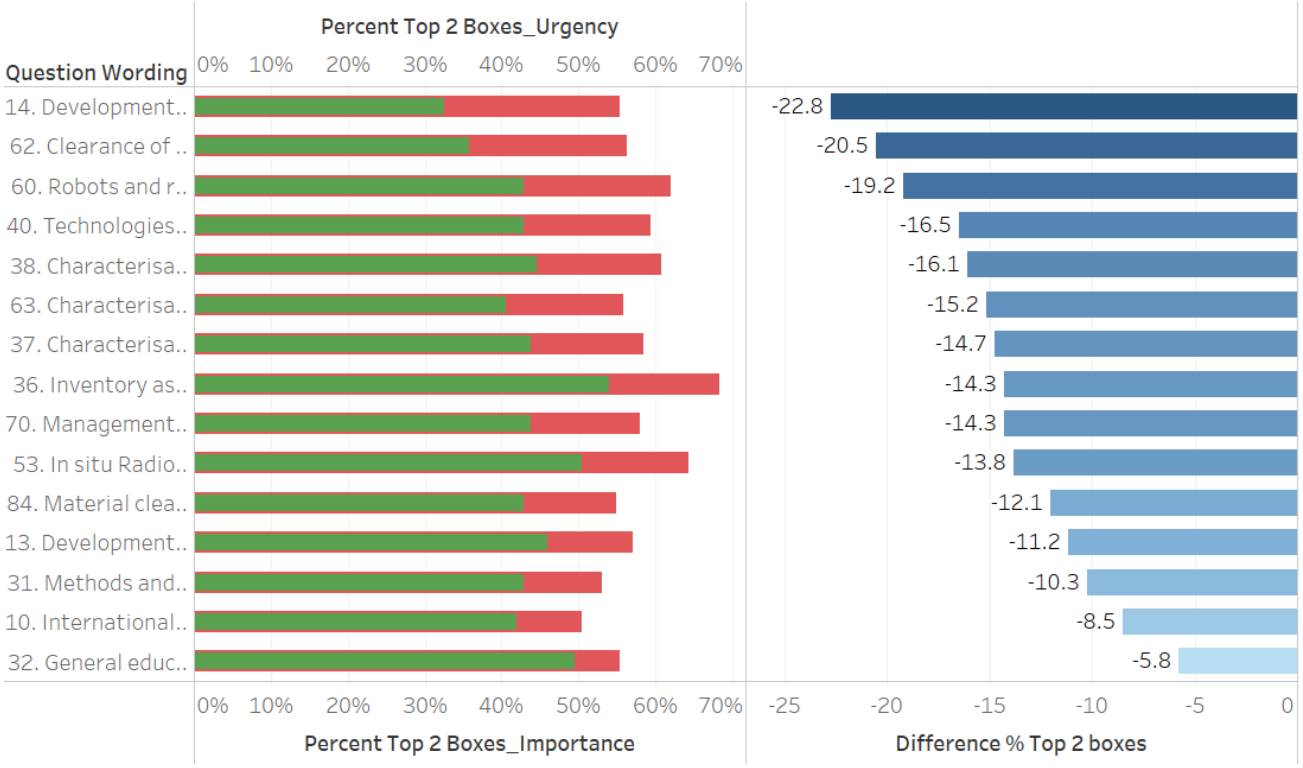


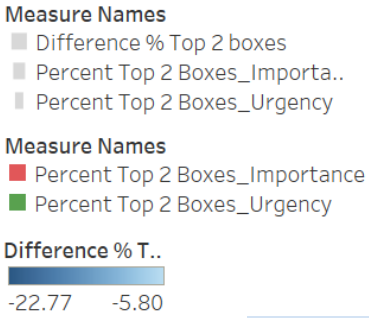
Total scoring most highly scored

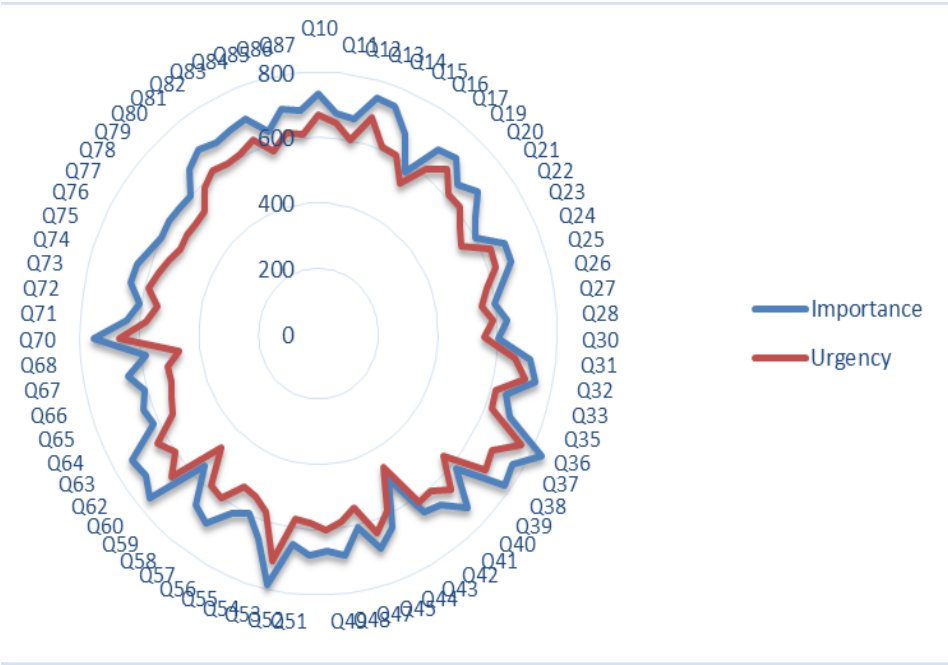
IMPORTANCE & URGENCY

SHARE
A roadmap for research in Decommissioning

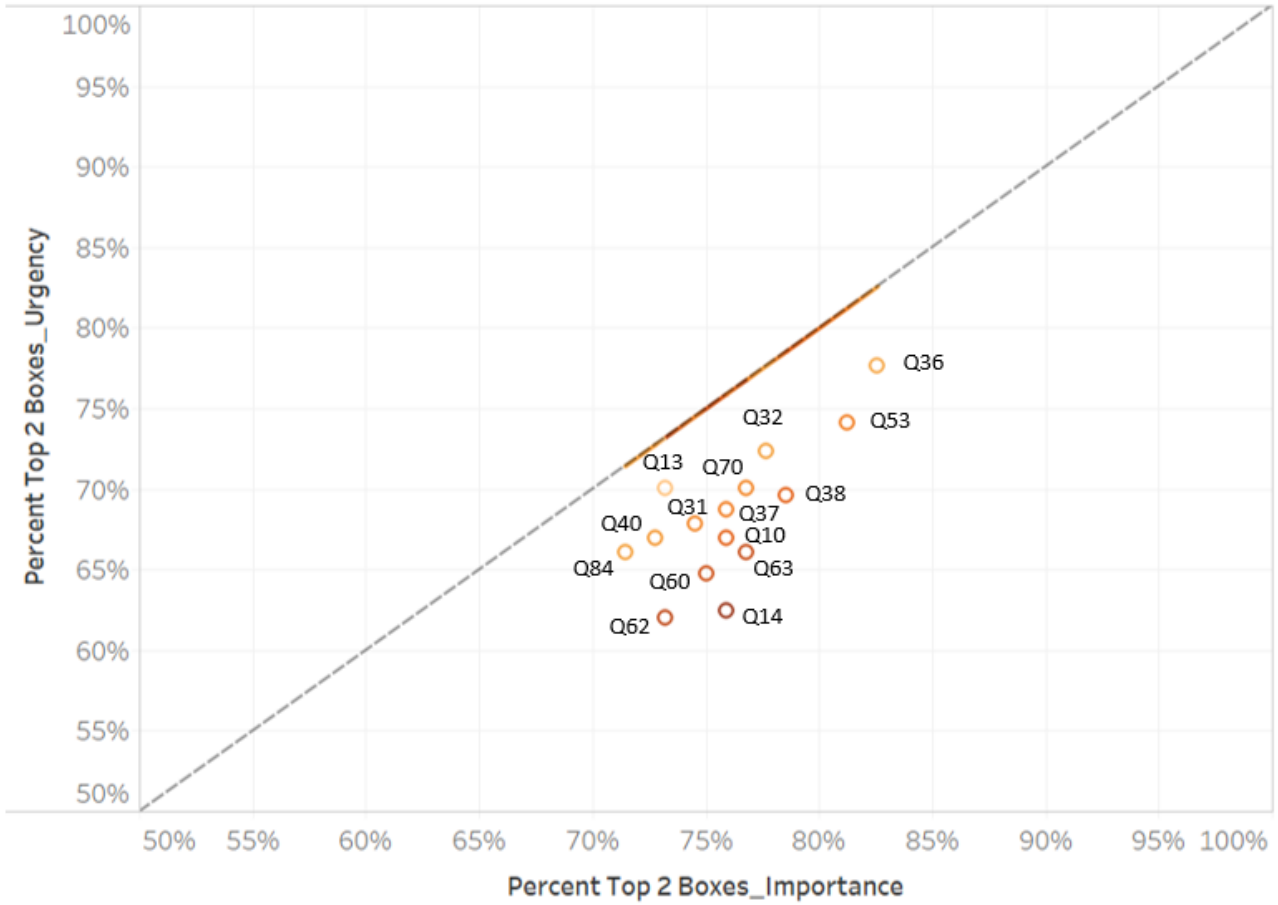
Bar chart with difference (% top 2 boxes) Most Highly Scored







IMPORTANCE + URGENCY



36 - INVENTORY ASSESMENT (RADIOLOGICAL AND NON RADIOLOGICAL)
53 - IN SITU RADIOACTIVE WASTE CHARACTERIZATION
38 - CHARACTERIZATION OF ACTIVATED COMPONENTS AND AREAS (CONCRETE)
32 - GENERAL EDUCATION FOR DECOMMISSIONING
37 - CHARACTERIZATION OF ACTIVATED COMPONENTS AND AREAS (METAL)
13 - DEVELOPMENT FOR NATIONAL REGULATORY GUIDANCE FOR CLEARANCE (STRUCTURES AND MATERIALS)
70 - MANAGEMENT ROUTES FOR MATERIALS INCLUDING RADIOACTIVE WASTE STREAMS
60 - ROBOTS AND REMOTE CONTROL TOOLS FOR DISMANTLING
10 - INTERNATIONAL HARMONIZATION OF SAFETY STANDARDS AND SAFETY APPROACHES FOR DECOMMISSIONING
40 - TECHNOLOGIES FOR HARD TO ACCESS AREAS
31 –METHODS AND SOFTWARE TOOLS FOR KNOWLEDGE MANAGEMENT (E.G. COMPETENCE PRESERVATION)
63 – CHARACTERIZATION METHODS AND TECHNOLOGIES TO IDENTIFY SUBURFACE CONTAMINATION
14 - DEVELOPMENT FOR NATIONAL REGULATORY GUIDANCE FOR DECOMMISSIONING (FINAL SITE RELEASE)
84 - MATERIAL CLEARANCE (METHODOLOGY AND PROCEDURES)
62 – CLEARANCE OF SURFACES AND STRUCTURES (INTERIOR AND EXTERIOR)

NEXT STEPS

Modifiez le style du sous-titre

- Additional data assessment on going.

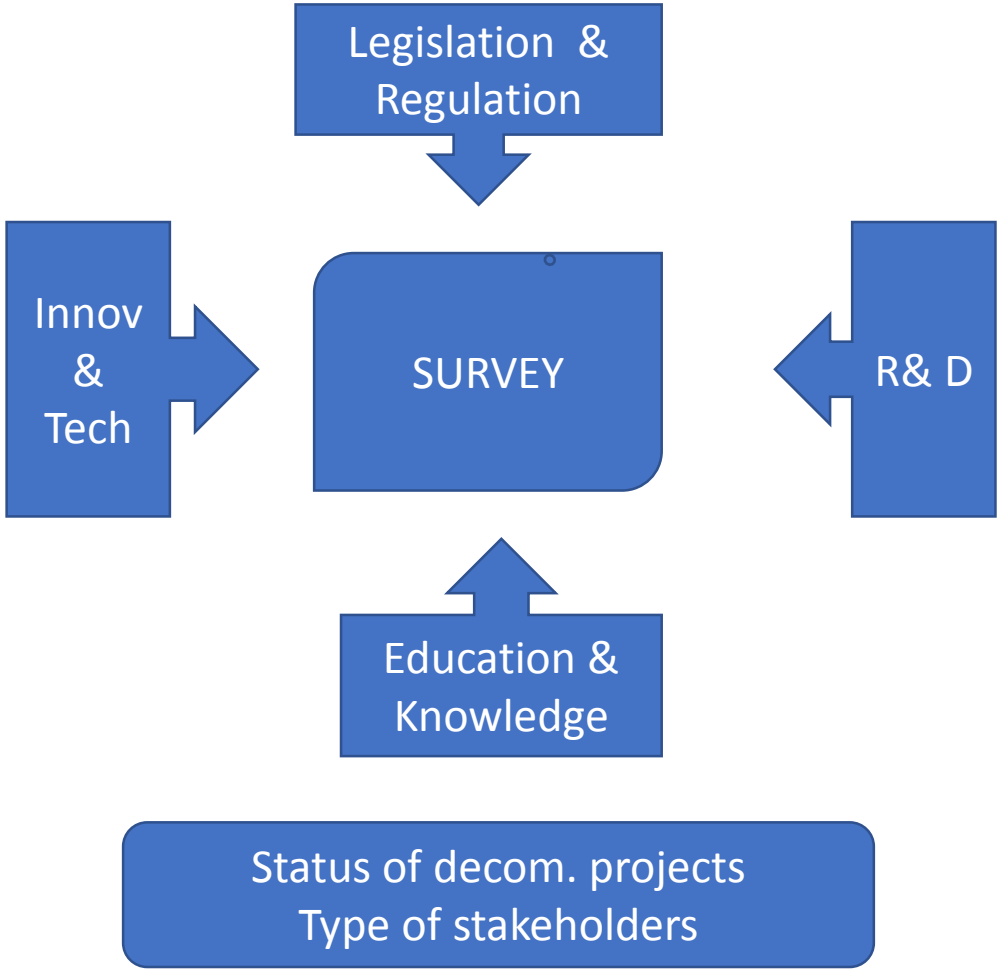
  ✓Effects of the number of responses from specific regions /countries.

  Distortion of the overall results?

  ✓Analysis of answers received to open questions.

  Any potential needs not considered?

Four dimensions & two weighing factors



NEXT STEPS

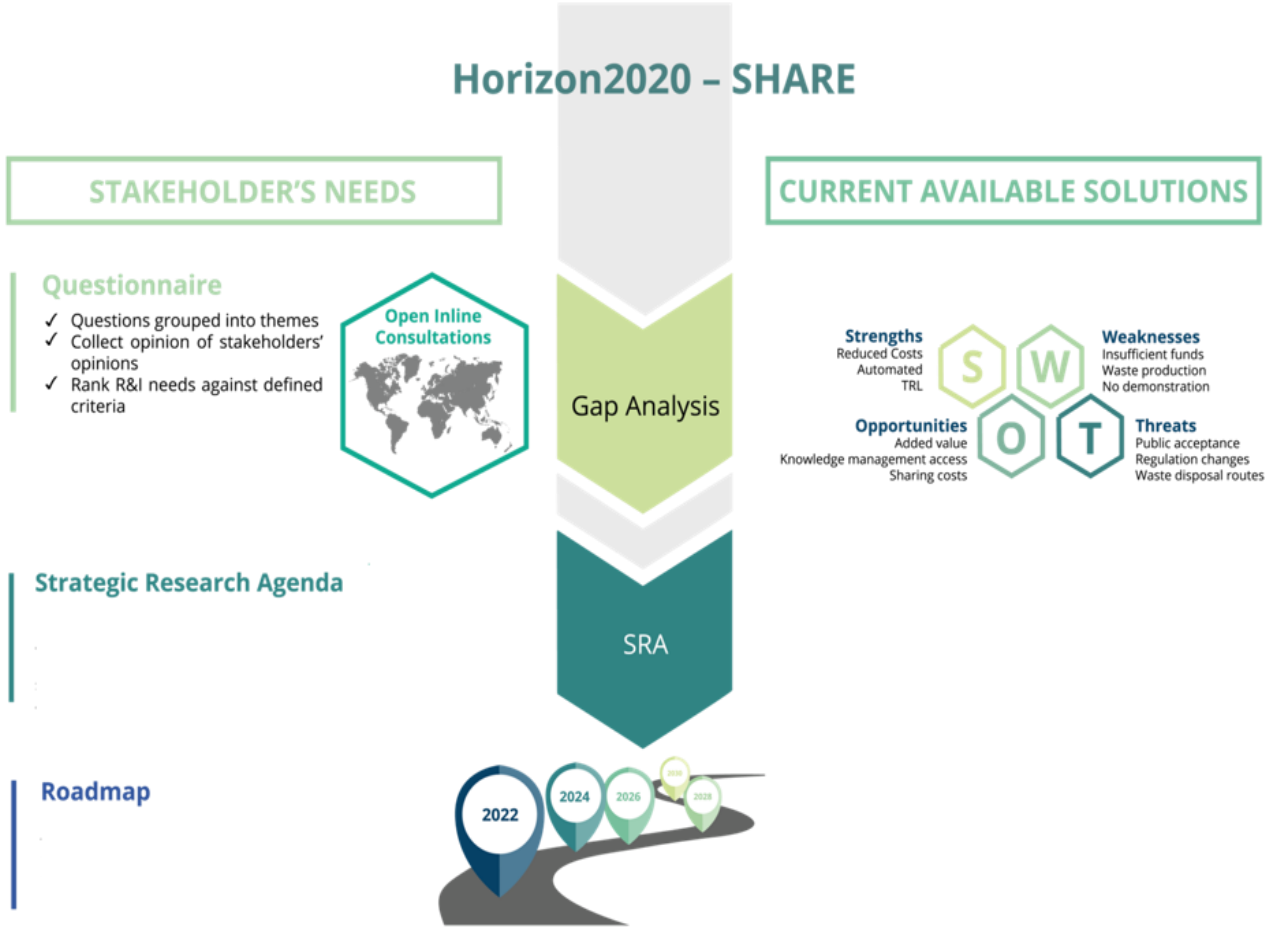
Modifiez le style du sous-titre

- Sharing survey preliminary results: discussion with stakeholders

- Comparison of research needs on decommissioning (WP2) and available solutions (WP3) - gap analysis.

Thank you for your attention!

Any question?



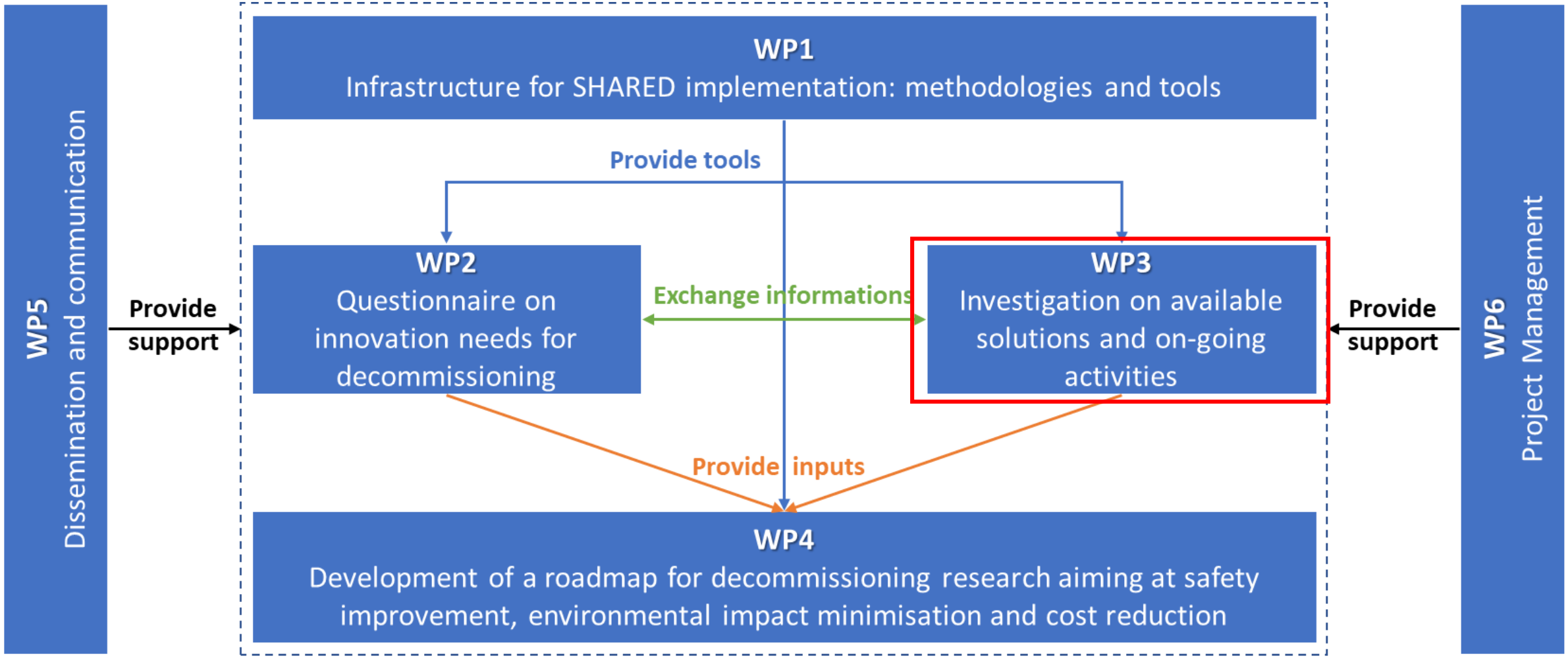
EU-H2020- SHARE-Decommissioning
On-line Workshop, December 1-3, 2020

SHARE - WP3 Introduction

Lead : NNL (UK)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement nº 847626.

WP3 in the PERT chart



WP3 Tasks

- **Task 1 :** Review of international best practice and advanced technologies in radioactive waste management, environmental remediation and decommissioning
- **Task 2 :** Assessment and comparison of technology/ work practices – GAP Analysis/ Benchmark
- **Task 3 :** International collaborative technology development initiatives

Task 1 – Collate best practices

Tasks and associated Deliverables & Milestones

Description of work:

Review of international best practice and advanced technologies in radioactive waste management, environmental remediation and decommissioning

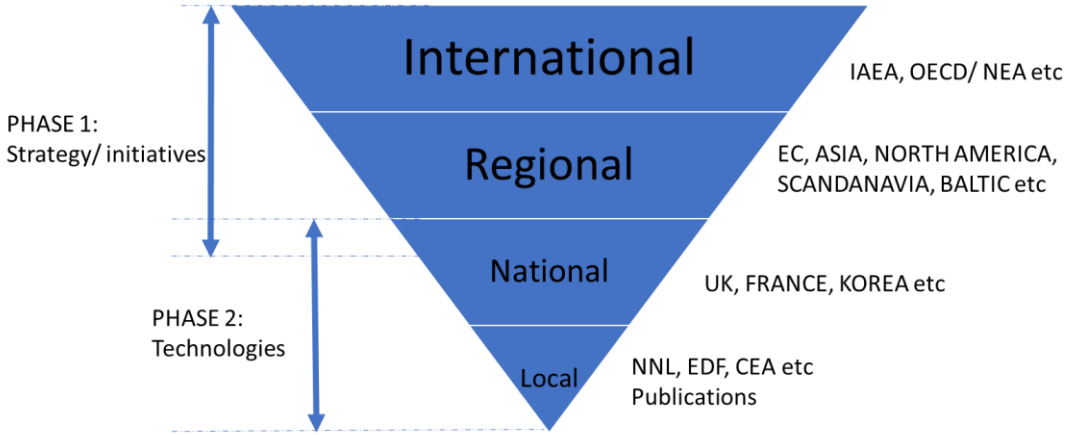
- Literature review of technologies, methodologies and organisational best practices
- Split into 3 geographical areas (Europe, Asia, America's) and data standardised using drivers developed in WP1 (D1.2)
- Research conducted through existing databases and workshops (journals, conference papers, industry reports etc)
- Workshop reviews held alongside key international conferences - with WP2 - to consolidate and verify knowledge

Leader: SOGIN / Participant: NNL, SOGIN, CEA, KIT, LEI, JRC, IFE

Associated Deliverables:

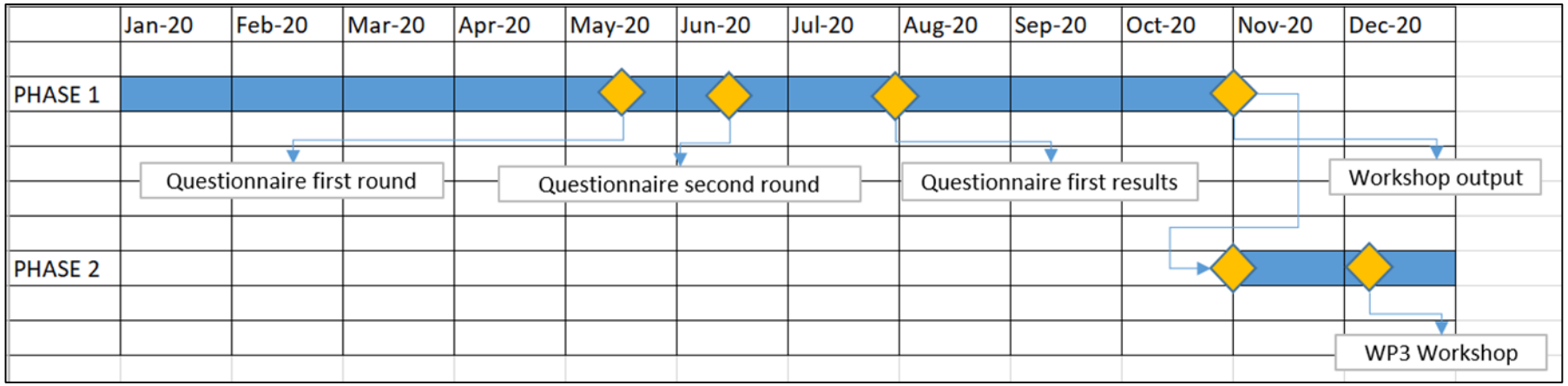
Report detailing applicable technologies/ methodologies

Task 1: Report detailing applicable technologies/ methodologies (Dec 2020)



PHASE 1: a general overview on the topics of the questionnaire considering the state of the art of what is present

PHASE 2: a focus on the TOP selected topics, considering also the national ongoing research and development activities



Task 1: Distribution of work /review Task 3.1

SHARE
A roadmap for research in Decommissioning

Questionnaire Topic Area	TOPIC AREA LEADER	SUB-TOPIC LEADER	Q	D3.1 §	Sub-topic
Safety and Radiological Protection aspects	IFE	JRC	10	1.1	International harmonization of safety standards and safety approaches for Decommissioning
		LEI		1.2	Development for National regulatory guidance for Decommissioning
			11	1.2.1	- Preparatory activities
			12	1.2.2	- Dismantling
			13	1.2.3	- Clearance of structures and materials
			14	1.2.4	- Final site release
		SOGIN	15	1.3	Methods and tools nuclear safety
		SOGIN	16	1.4	Methods and tools for conventional industrial safety
		CEA/CEPN	17	1.5	Development of radiological protection approaches and guidance for Decommissioning
Project Management and costing	CEA	LEI	19	2.1	Methodologies and software tools for comparison of alternative decommissioning strategies
		LEI	20	2.2	Methodologies and software tools for project management and performance monitoring
		VTT	21	2.3	Tools for data collection in the field (e.g. for work monitoring)
		IFE	22	2.4	Digital transformation in decommissioning (big data, business intelligence)
		VTT	23	2.5	Supply chain management for Decommissioning
		IFE	24	2.6	Methods and tools for communication (public)
		SOGIN	25	2.7	Methodologies and guidance for cost estimation
		LEI	26	2.8	Software for cost estimation
		SOGIN	27	2.9	Development of mechanisms for cost benchmarking
		SOGIN	28	2.10	Methods and tools for sensitivity and uncertainty analysis in cost estimation
Human resources management	IFE	IFE	30	3.1	Organisation models (staff and resources)
		IFE	31	3.2	Methods and software tools for knowledge management (e.g. competence preservation)
		IFE	32	3.3	General education for decommissioning
		IFE	33	3.4	Methodologies and tools for task specific training
Characterisation during decom.	JRC	CEA	35	4.1	Methodology for historical site assessment
		CEA	36	4.2	Inventory assessment (Radiological and non-radiological)
		NNL		4.3	Characterisation of activated components and areas
			37	4.3.1	- Metal
			38	4.3.2	- Concrete
			39	4.3.3	- Graphite
		ENRESA	40	4.4	Technologies for hard to access areas (high walls, embedded components, harsh environment…)
		CEA	41	4.5	Development of modelling and simulation software for characterisation of irradiated components
		CEA	42	4.6	Standards for statistical sampling
		CEA	43	4.7	Geostatistical software applications
		JRC	44	4.8	Sample analysis technologies
		CEA	45	4.9	Alpha and beta non-destructive measurements
Site preparatory activities	SOGIN	LEI	47	5.1	Adaption of auxiliary systems for decommissioning (ventilation, electrical, monitoring, etc.)
		SOGIN	48	5.2	Preparation of infrastructures and buildings for decommissioning (storages, capabilities for material sorting and treatment…)
		NNL	49	5.3	Systems decontamination (internal)

Task 1: Distribution of work /review Task 3.1

Dismantling	**KIT**	SOGIN	**51**	**6.1**	Segmentation of large irradiated metallic components (reactor vessel internals, etc.)
		KIT	**52**	**6.2**	Handling, segregation and loading of segmented elements and secondary waste
		NNL	**53**	**6.3**	In situ Radioactive Waste characterization and segregation
		LEI	**54**	**6.4**	Segmentation of large surface-contaminated components
		LEI	**55**	**6.5**	Dismantling of surface-contaminated piping and small components
		KIT	**56**	**6.6**	Segmentation of interior concrete structures (e.g., bioshield)
		KIT	**57**	**6.7**	In situ decontamination of building surface (concrete)
		KIT	**58**	**6.8**	Management (characterization, decontamination, removal) of radiological embedded elements
		KIT	**59**	**6.9**	Demolition of large, reinforced concrete structures
		KIT	**60**	**6.10**	Robots and remote controlled tools for dismantling
Environmental remediation and Site Release	**SOGIN**	SCK-CEN	**62**	**7.1**	Clearance of surfaces and structures (interiors and exteriors)
		NNL	**63**	**7.2**	Characterisation methods and technologies to identify subsurface contamination
		NNL	**64**	**7.3**	Modelling and statistical tools to analyse contaminant transport in subsurface soil and groundwater
		CEA	**65**	**7.4**	Soil remediation technologies (washing, bioremediation, contamination fixing)
		SOGIN	**66**	**7.5**	Remediation of contaminated groundwater (radiological)
		SOGIN	**67**	**7.6**	Methodologies and techniques for final release survey of the Site
		SOGIN	**68**	**7.7**	Tools for statistical analysis and management of survey data for site release
Management of material and radioactive waste from decommissioning	**NNL**	ENRESA	**70**	**8.1**	Management routes for materials including radioactive waste streams
		NNL		**8.2**	Radioactive material decontamination
			71	**8.2.1**	- Mechanical
			72	**8.2.2**	- electrochemical
		NNL		**8.3**	Radioactive material treatment processes
			73	**8.3.1**	- metals
			74	**8.3.2**	- concrete
			75	**8.3.3**	- aqueous liquids
			76	**8.3.4**	- non aqueous liquids
			77	**8.3.5**	- organic materials
			78	**8.3.6**	- VLLW
			79	**8.3.7**	- LLW
			80	**8.3.8**	- ILW
		NNL	**81**	**8.4**	Radioactive waste conditioning
		JRC	**82**	**8.5**	Radioactive waste packaging and logistics
		CEA	**83**	**8.6**	Characterization and survey of containerized radioactive waste
		ENRESA		**8.7**	Material clearance
			84	**8.7.1**	- methodology and procedures
			85	**8.7.2**	- instrumentation and logistics
		ENRESA	**86**	**8.8**	Management of hazardous and toxic materials (asbestos, lead in paint, etc.)
		NNL	**87**	**8.9**	Conventional and cleared materials recycling (circular economy)

Task 2 – Gap Analysis

Tasks and associated Deliverables & Milestones

Description of work:

Assessment and comparison of technology/ work practices – GAP Analysis/ Benchmark

- Technologies from task 3.1 (D3.1)
- Results questionnaire survey in WP2 (D2.3 & D2.4)
- Methodology developed in WP1 (D1.2)

→ GAP analysis

Leader : KIT / Participant : ENRESA, CEA, JRC

Associated Deliverables:

Technology assessment/ gap analysis report

SHARE December Workshop

- What are **YOUR NEEDS?**
- Where are **THE GAPS** the we should be identifying in the gap analysis?

How will we achieve this? Post-it Notes

Modifiez le style du titre

STEP 1	What are the important **NEEDS** in Research* in this area?	ISSUES? CHALLENGES? OPPORTUNITIES?	
STEP 2	The facilitator will group step 1's issues, challenges and opportunities by **NEED**.	Extraction NEEDS Discussion on NEEDS Agreement	 
STEP 3	What are the **SOLUTIONS** and **OPPORTUNITIES** to meet this NEED?	Implemented Under Development Not Developed	Is there a GAP? Why is there a GAP? 
STEP 4 (Optional) Depending on time	What are the **ACTIONS** (technical and non technical) that can fill this gap?	ACTIONS	 

Task 3 – International collaborative initiatives

Tasks and associated Deliverables & Milestones

Description of work:

International collaborative technology development initiatives

- Literature review of international experience in developing multi-national collaborations
- Focus on both nuclear and non-nuclear initiatives
- Output will feed into WP4 to develop roadmap

Leader: NNL / Participant: IFE, CEA

Associated Deliverables:

Report identifying and comparing international collaborative research initiatives

SHARE December Workshop - Output

- What are **YOUR NEEDS?**
- Where are **THE GAPS** the we should be identifying in the gap analysis?
- Bonus: Are there any international collaborative initiatives we should be aware of?

EU-H2020- SHARE-Decommissioning

EU programmes in Decommissioning

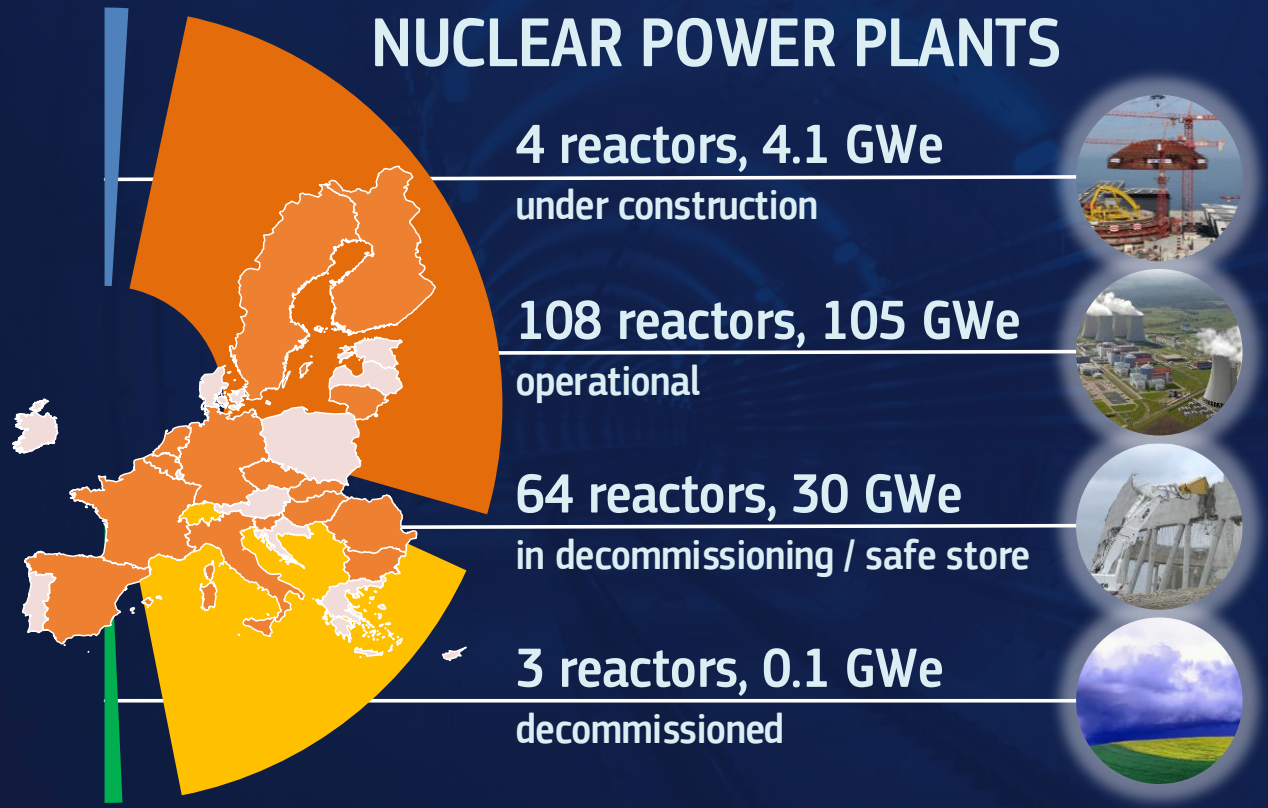
G. Brunetti
Deputy Head of Unit
'Nuclear energy, nuclear waste and decommissioning'
European Commission – Directorate General for Energy

Energy

On-line workshop, 1st December 2020

Nuclear Decommissioning

activities have increased and will further grow in the European Union



NUCLEAR POWER PLANTS

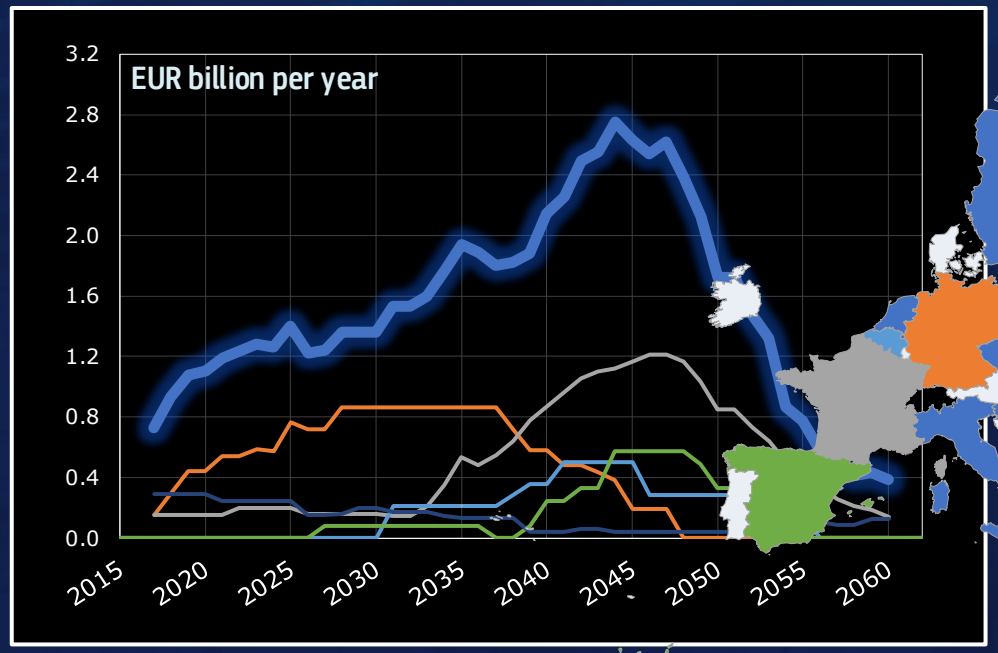
4 reactors, 4.1 GWe
under construction

108 reactors, 105 GWe
operational

64 reactors, 30 GWe
in decommissioning / safe store

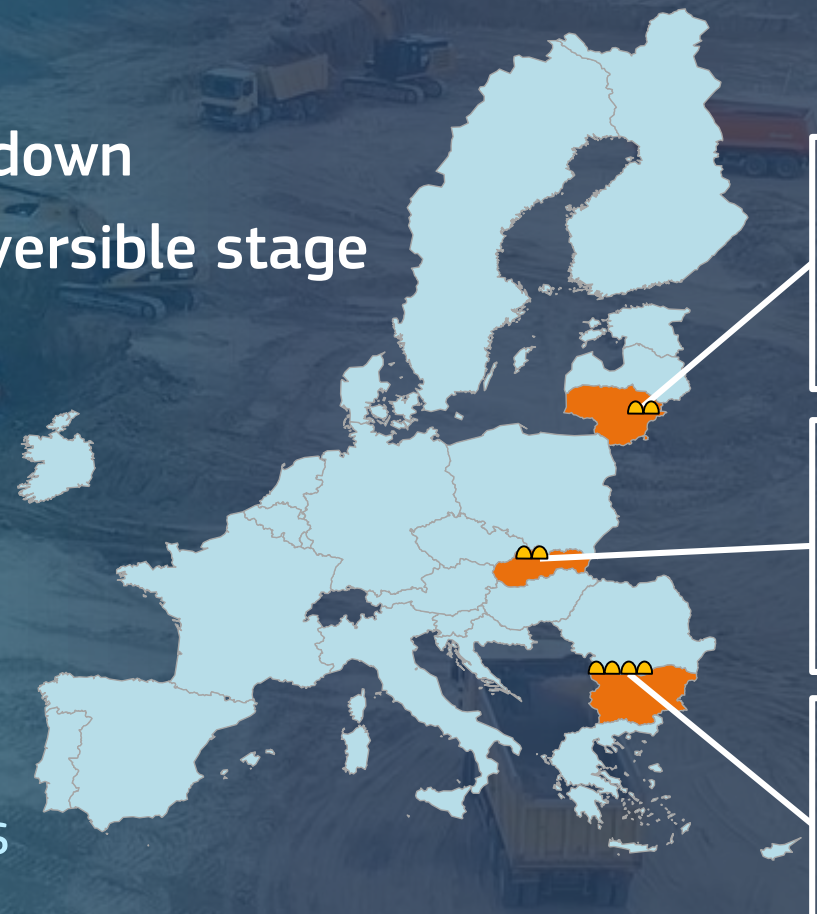
3 reactors, 0.1 GWe
decommissioned

The total projected expenditures in decommissioning in the EU until 2060 are estimated at ~EUR 65 billion



Nuclear Decommissioning Assistance Programmes

- Eight reactors **permanently shut-down**
- Dismantling progressed to an **irreversible stage**
- The objectives of the programmes in the MFF 2014-2020 met **within the allocated budget**
- **End-dates of decommissioning** identified in 2014 **remain unchanged**
- **EU co-funding** of the programmes in the **next MFF 2021-2027**



Ignalina programme (LT)

Unit 1 Shut-down	**2004**
Unit 2 Shut-down	**2009**
Programme End-Date	**2038**

Bohunice programme (SK)

Unit 1 Shut-down	**2006**
Unit 2 Shut-down	**2008**
Programme End-Date	**2025**

Kozloduy programme (BG)

Units 1-2 Shut-down	**2002**
Units 3-4 Shut-down	**2006**
Programme End-Date	**2030**

Bohunice programme

- Support to Slovakia in carrying out the decommissioning of **Bohunice V1 nuclear power plant** (two reactors VVER type) in line with the **highest safety standards**
- The **European Union** has contributed **EUR 681 million**
- The European Commission has proposed a further contribution of **EUR 55 million for completing the programme** under the multiannual financial framework spanning from 2021 to 2027
- **Slovak national funds** cover with **EUR 476 million**
- Total cost estimate in 2017 **EUR 1238 million**

Energy

Kozloduy programme

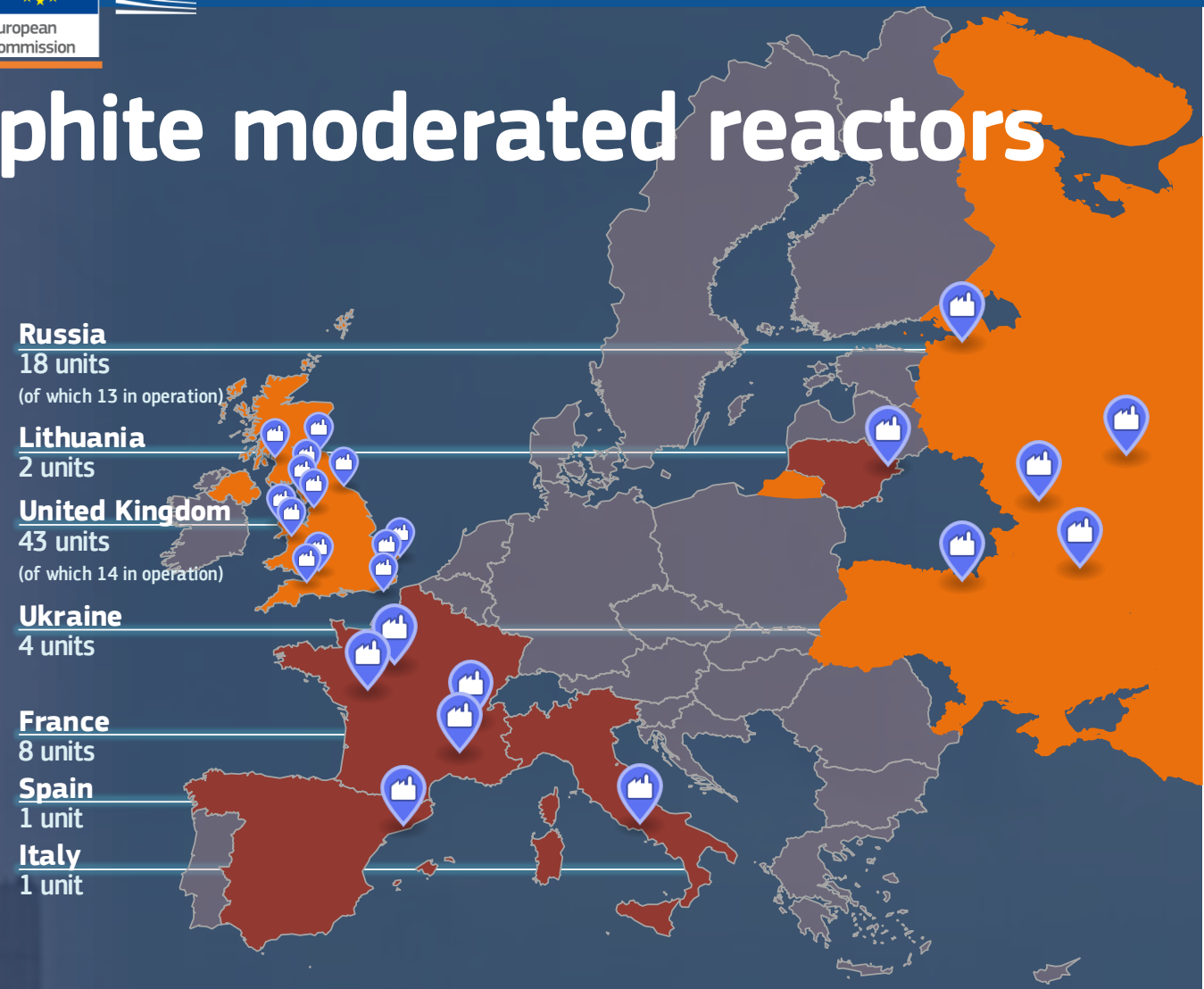
- Support to Bulgaria in carrying out the decommissioning of **Kozloduy nuclear power plant units 1-4** (four reactors VVER type) in line with the **highest safety standards**
- The **European Union** has contributed **EUR 800 million**
- The European Commission has proposed a further contribution of **EUR 63 million for completing the programme** under the multiannual financial framework spanning from 2021 to 2027
- **Bulgarian national funds** cover with **EUR 458 million**
- Total cost estimate in 2017 **EUR 1358 million**

High temperature treatment process, plasma melting reduces the volume of radioactive waste up to 50 times

- Minimised cost for disposal
- Stable waste form

Decommissioning of graphite moderated reactors

- Removal of graphite from reactor-cores and its subsequent management as radioactive waste:
  yet unsolved technological challenges
- Generally safe-storage of shut-down units and deferred decommissioning
- Ignalina programme, EU supports Lithuania in decommissioning **two 1.5 GWe RBMK reactors**
- The programme aims at **delivering technological solutions and creating know-how** for dismantling this reactors' type in line with the **highest safety standards**



Ignalina programme

- Support to Lithuania in carrying out the decommissioning of **Ignalina nuclear power plant** (two reactors RBMK type) in line with the **highest safety standards**.
- The **European Union** has contributed **EUR 1568 million**
- The European Commission has proposed a further contribution of **EUR 552 million** under the multiannual financial framework spanning from 2021 to 2027
- **Lithuania** covers **14%** with **EUR 478 million**
- Total cost estimate in 2017 **EUR 3377 million**

SHUT DOWN

2004 Unit 1

2009 Unit 2

2013
Start of turbine halls equipment dismantling

201X
Construction of the spent fuel dry storage facility

2016
Start of transfer of spent fuel to the storage

2019
Start of operations of waste management facilities

2020
End of turbine halls equipment dismantling

2021
End of transfer of spent fuel to the storage

Summary of studies

...published

- **Study on market for decommissioning nuclear facilities in the European Union**
  https://ec.europa.eu/energy/en/studies/study-market-decommissioning-nuclear-facilities-european-union **ISBN 978-92-76-08711-3**
- **Study on the risk profile of the funds allocated to finance the back-end activities of the nuclear fuel cycle in the EU**
  https://ec.europa.eu/energy/en/studies/study-risk-profile-funds-allocated-finance-back-end-activities-nuclear-fuel-cycle-eu **ISBN 978-92-76-08713-7**
- **Support to the mid-term evaluation of the nuclear decommissioning assistance programmes**
  https://ec.europa.eu/energy/studies/support-mid-term-evaluation-nuclear-decommissioning-assistance-programmes_en **ISBN 978-92-76-08717-5**

...upcoming...

- Study on the insurance, private and financial markets in the field of **nuclear third party liability**
- **Methodologies of cost assessment** for radioactive waste and spent fuel management. An overview of the practices adopted in the EU
- Benchmarking analysis of Member States approaches to **definition of national inventories** radioactive waste and spent fuel

in preparation...

- Study on **Key Performance Indicators for monitoring implementation of national programmes** on safe and long-term management of spent fuel and radioactive waste
- Study to support the **ex post evaluation of the nuclear decommissioning assistance programme 2014-2020**

THANK YOU

https://ec.europa.eu/energy/en/home

IAEA
International Atomic Energy Agency

IAEA networks and activities related to D&ER

Olena Mykolaichuk

Decommissioning and Environmental Remediation Section (DERS)

Division of Nuclear Fuel Cycle and Waste Technology (NEFW)

SHARE Workshop

1 December 2020

IAEA - Overview

Established in 1957

172 Member States

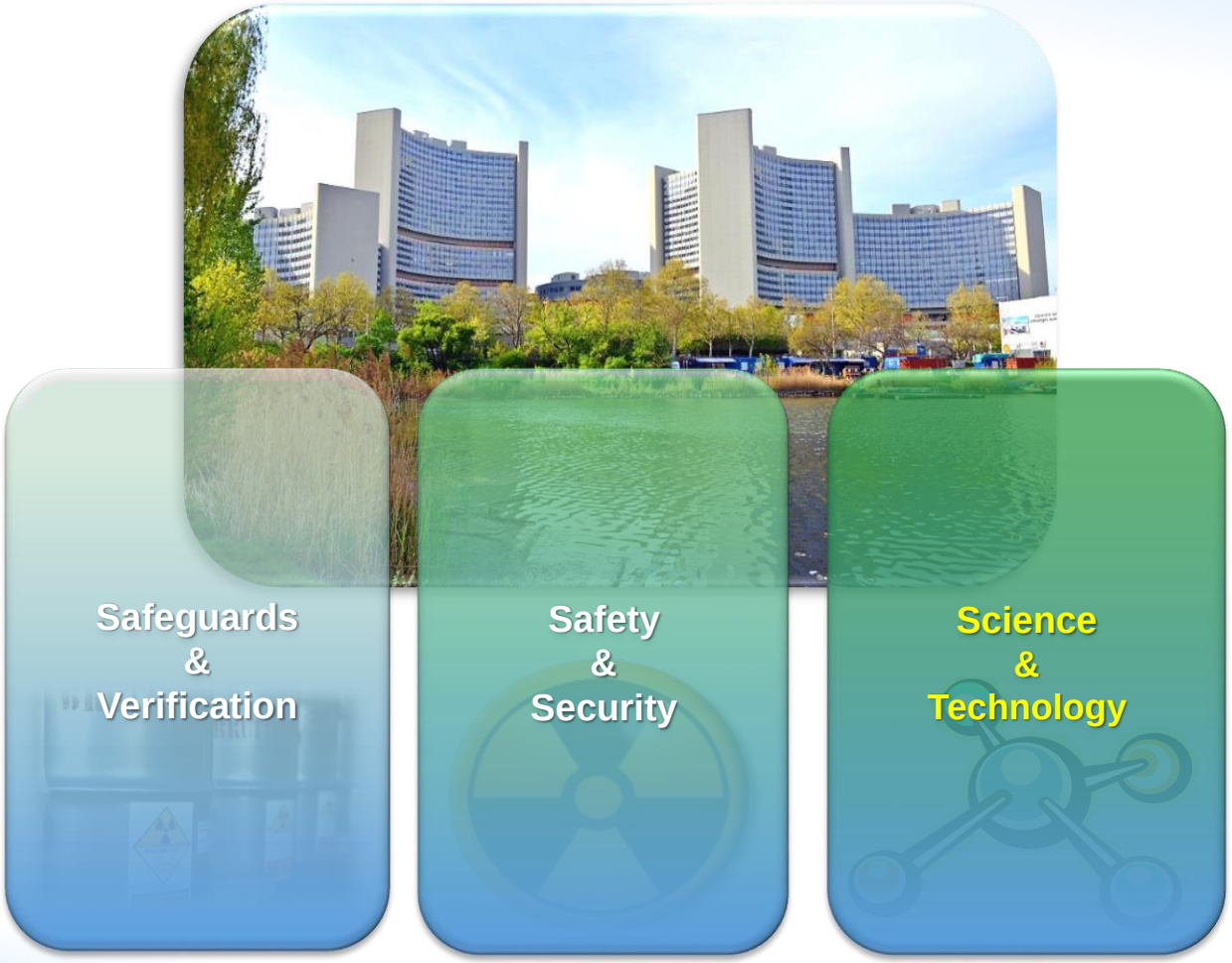
~ 2,500 multidisciplinary professional and support staff from more than 100 countries

Statute, Article II, *Objectives*

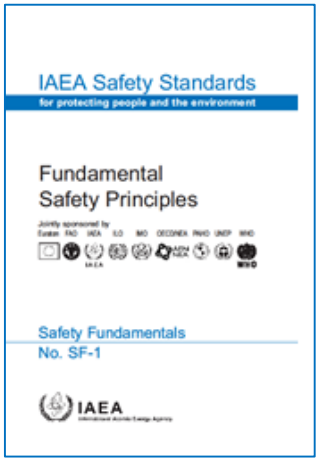
The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world.

ATOMS FOR PEACE AND DEVELOPMENT

Three Pillars - Main Areas of Activity

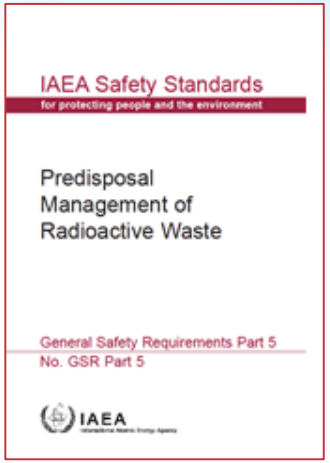


Safety Standards

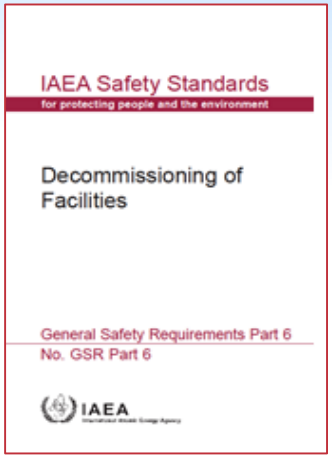


2006

2014

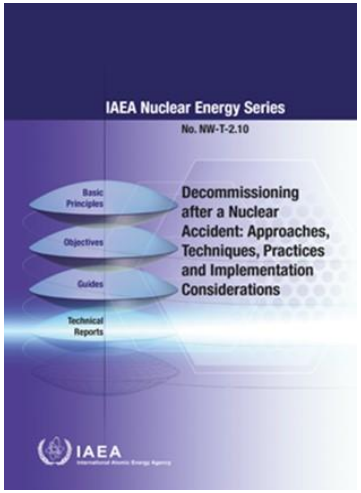


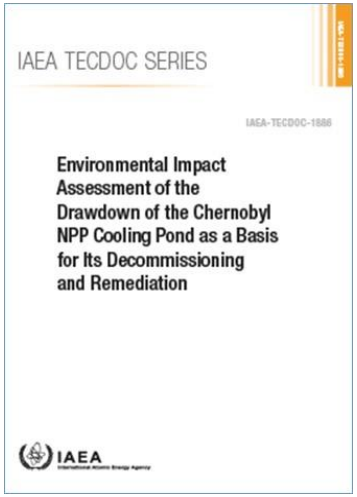
2009

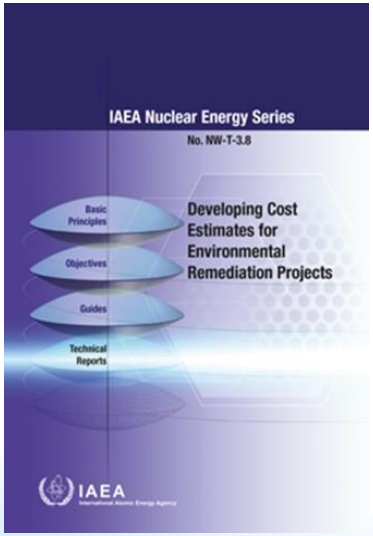


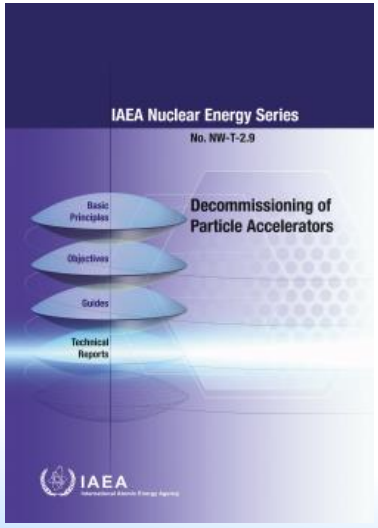
2014

IAEA Nuclear Energy Series, TRS +









Advanced in preparation:

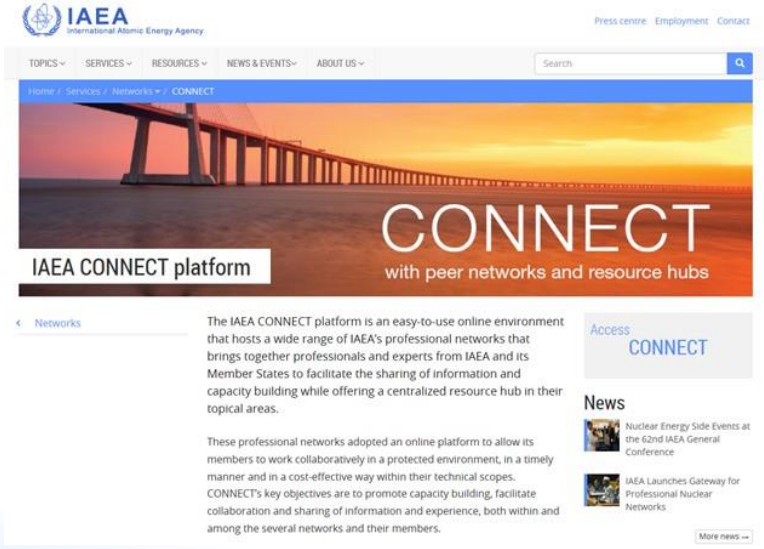
- Data Analysis and Collection for Costing of Research Reactor Decommissioning (DACCORD Report Phase 2)
- Training and Human Resource Considerations for Nuclear Facility Decommissioning: NG-T-2.3 (Rev.1),
- Integrated Approach to Decommissioning within a Multi-Facility Site
- Technical Aspects Related to the Design of Engineered Containment Barriers in Environmental Contamination (*TRS*)
- Determination of Environmental Remediation End States
- Evaluation, Management and Remediation of Trenches containing Historic Radioactive Wastes: Legacy Trench Sites

At early drafting stage:

- Global Status of Decommissioning
- Policies and Strategies for NORM Residue and Waste Management
- International Network on Irradiated Graphite Processing Approaches (GRAPA). Summary of results (*TECDOC*)
- ….

IAEA professional networks

- International Decommissioning Network (IDN), 2007;
- Network on Environmental Management and Remediation (ENVIRONET), 2009;
- International Network of Laboratories for Nuclear Waste Characterization (LABONET), 2011;
- International Predisposal Network (IPN), 2016;
- Supported by the IAEA CONNECT – a platform available to all IAEA professional networks or communities of practice and its members.



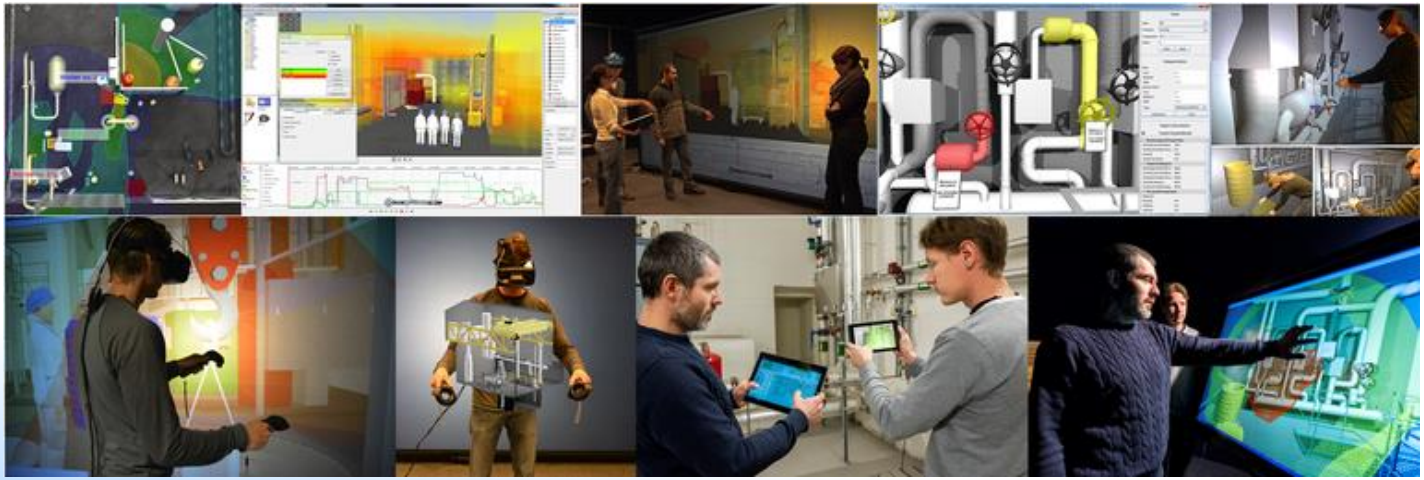
IAEA Collaborating Centres on Decommissioning

Objectives:

- To promote innovation in decommissioning
- To facilitate knowledge sharing on current good practice
- To assist in long-term developing a qualified workforce through supporting a number of fellowships (i.e. secondments of several months' duration).

Starting a network of Collaborating Centres:

- IFE (Institute for Energy Technology), Norway – targeting issues of digitalization of knowledge management for decommissioning
- Sogin, Italy – targeting knowledge management and training for decommissioning
- JAVYS, Slovakia – targeting WWER decommissioning and project management
- EDF/DP2D (Graphite Reactor Decommissioning Demonstrator) – targeting graphite reactor decommissioning

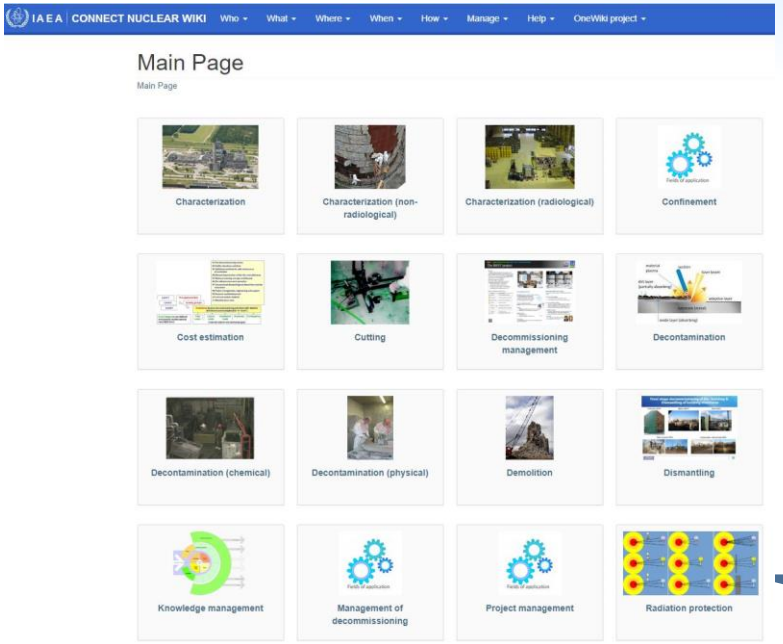


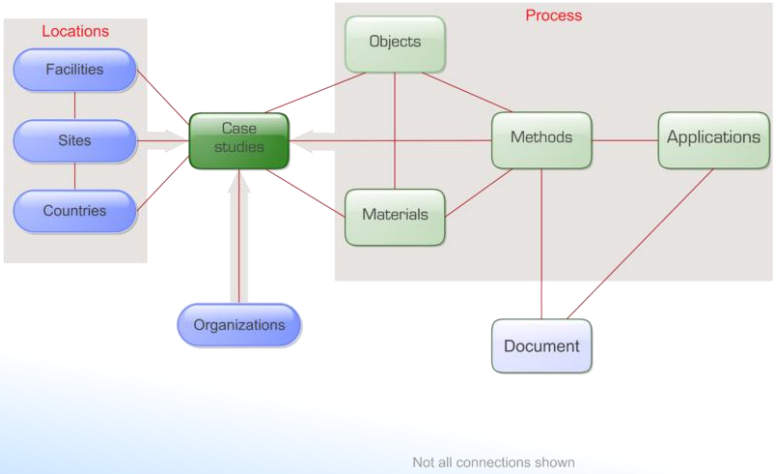
Courtesy of IFE, Norway

Some Ongoing and Upcoming Projects

- **MIRDEC** (Decommissioning of Smaller Facilities)
- **COMDEC** (Completion of Decommissioning)
- **NORM** (complex project)
- **Decommissioning in the Context of Circular Economy**
- **Global Status of Decommissioning**
- **MAESTRI** (Improve Decision Making in the Context of ER Projects)
- **Use of Controls for Radioactively Contaminated Land**
- **Decommissioning Considerations for SMRs**
- **Advancing Knowledge Management for Decommissioning**
- **Decommissioning of Graphite Reactors**
- **Decommissioning of Sodium-cooled fast reactors**
- **Human Resource Development for Decommissioning Phase II**

Development of IDN Decommissioning Wiki





https://connect-nuclear-wiki.iaea.org/wiki/Main_Page

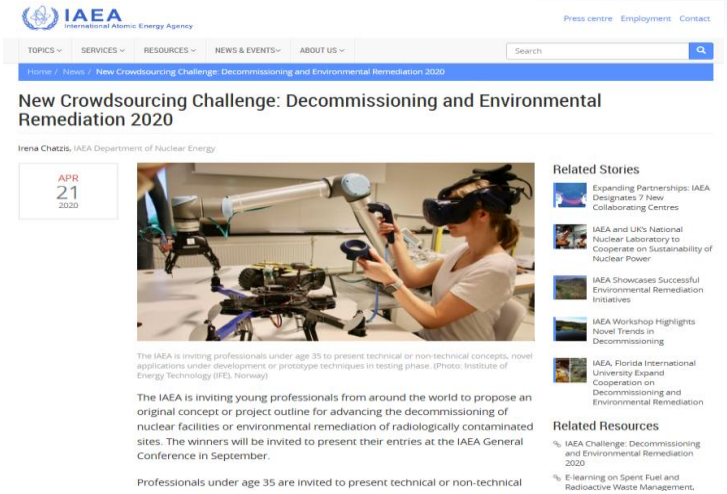
Nuclear Wiki - launched on NUCLEUS (July 2020)

- Initiated in 2016 by International Decommissioning Network
- Based on Semantic MediaWiki Technology
- Aim – sharing knowledge (technologies, case studies, facility information) between decommissioning professionals
- Content is reviewed (/quality checked) by a team of moderators
- Infrastructure maintained by IAEA Secretariat
- Content (as of 6 October 2020) is mainly decommissioning-related:
  - ➢250 case studies
  - ➢92 technologies in 27 “fields of application” (e.g. decontamination, characterization, knowledge management, etc.)
  - ➢127 glossary entries

Next Steps (2020-21)

- Development of the Nuclear-Wiki to a common, joint Wiki, including other networks as well as the integration of multilingual capabilities.
- Incremental addition of new subject domains (e.g. waste treatment, environmental remediation, waste disposal)
- Develop a parallel ‘Public’ version (Read only) from high quality articles
- Case studies aimed primarily at professional community only, i.e. not generally for public release

Young Generation Challenge: D&ER-2020


IAEA International Atomic Energy Agency

Press centre Employment Contact

TOPICS SERVICES RESOURCES NEWS & EVENTS ABOUT US Search

Home / News / New Crowdsourcing Challenge: Decommissioning and Environmental Remediation 2020

New Crowdsourcing Challenge: Decommissioning and Environmental Remediation 2020

Irena Chatzis, IAEA Department of Nuclear Energy

APR 21 2020

The IAEA is inviting professionals under age 35 to present technical or non-technical concepts, novel applications under development or prototype techniques in testing phase. (Photo: Institute of Energy Technology (IFE), Norway)

The IAEA is inviting young professionals from around the world to propose an original concept or project outline for advancing the decommissioning of nuclear facilities or environmental remediation of radiologically contaminated sites. The winners will be invited to present their entries at the IAEA General Conference in September.

Professionals under age 35 are invited to present technical or non-technical

Related Stories

Expanding Partnerships: IAEA Designates 7 New Collaborating Centres

IAEA and UK's National Nuclear Laboratory to Cooperate on Sustainability of Nuclear Power

IAEA Showcases Successful Environmental Remediation Initiatives

IAEA Workshop Highlights Novel Trends in Decommissioning

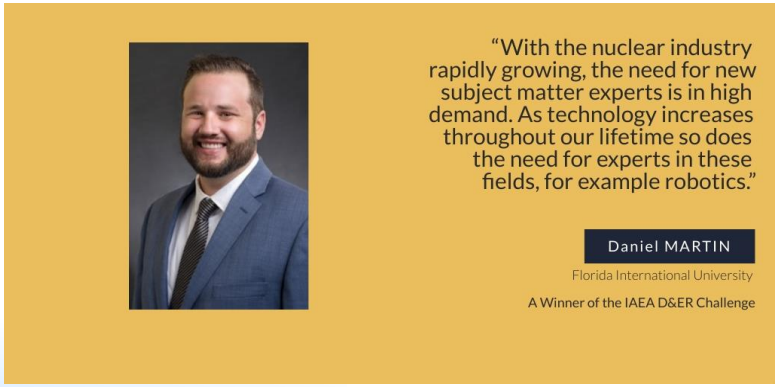
IAEA, Florida International University Expand Cooperation on Decommissioning and Environmental Remediation

Related Resources

IAEA Challenge: Decommissioning and Environmental Remediation 2020

E-learning on Spent Fuel and Radioactive Waste Management,

26 submissions from 12 Member States (North America, Europe and Asia) → we continue to work with the best top 5 authors to do further promotion of YG activities



International Conference on
Management of Naturally Occurring Radioactive Material (NORM) in Industry
19–23 October 2020, Vienna, Austria #NORM2020

IAEA

- Objective: Foster the sharing of experiences in the management of NORM in industrial operations to seek harmonization of safe and cost-effective approaches and dissemination
- 270 Abstracts submitted from all continents
- 1st IAEA Virtual Conference – 19-30 October 2020
- Fully virtual event, 10 working days, 7 topical sessions and 8 workshops
- 700+ participants to the Conference; 120 to 550 participants registered to the workshops;
- 105 Member States represented.
- Active involvement and participation of industries concerned (oil and gas, metallurgy, phosphates etc) as well as governmental bodies and research community

International Conference on Nuclear Decommissioning: Addressing the Past and Ensuring the Future

- Planned for 2Q 2023
- Joint endeavor of NE and NS departments
- Issues to be covered
  - Enablers (including funding, SF and waste infrastructure)
  - Planning and preparation
  - Transition from operation to decommissioning
  - Implementation of decommissioning
  - Completion and end-state
  - Effectiveness and efficiency
  - Safety and Security
- Ideas, inputs and cooperation are much welcome

Useful Links

- Wiki : https://idn-wiki.iaea.org/wiki/Main_Page
- Networks : https://nucleus.iaea.org/sites/connect/Pages/default.aspx

- eLearning: https://nucleus.iaea.org/sites/connect-members/LMS/Pages/Module-Mindmap.aspx
- INIS information repository: https://inis.iaea.org/search/
- Back-End webinars: https://www.iaea.org/about/organizational-structure/department-of-nuclear-energy/division-of-nuclear-fuel-cycle-and-waste-technology/nuclear-back-end-webinar-series

IAEA
International Atomic Energy Agency

Thank you!

Perspectives of the Nuclear Energy Agency on Relevant On-going Activities

Rebecca TADESSE
Head of RWMD Division
Nuclear Energy Agency

EU-H2020- SHARE-Decommissioning
On-line Workshop
December 1-3, 2020

Key Milestones at the NEA in Decommissioning


(ENSI, 2015)

1975

Establishment of the Radioactive Waste Management Committee (RWMC)

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

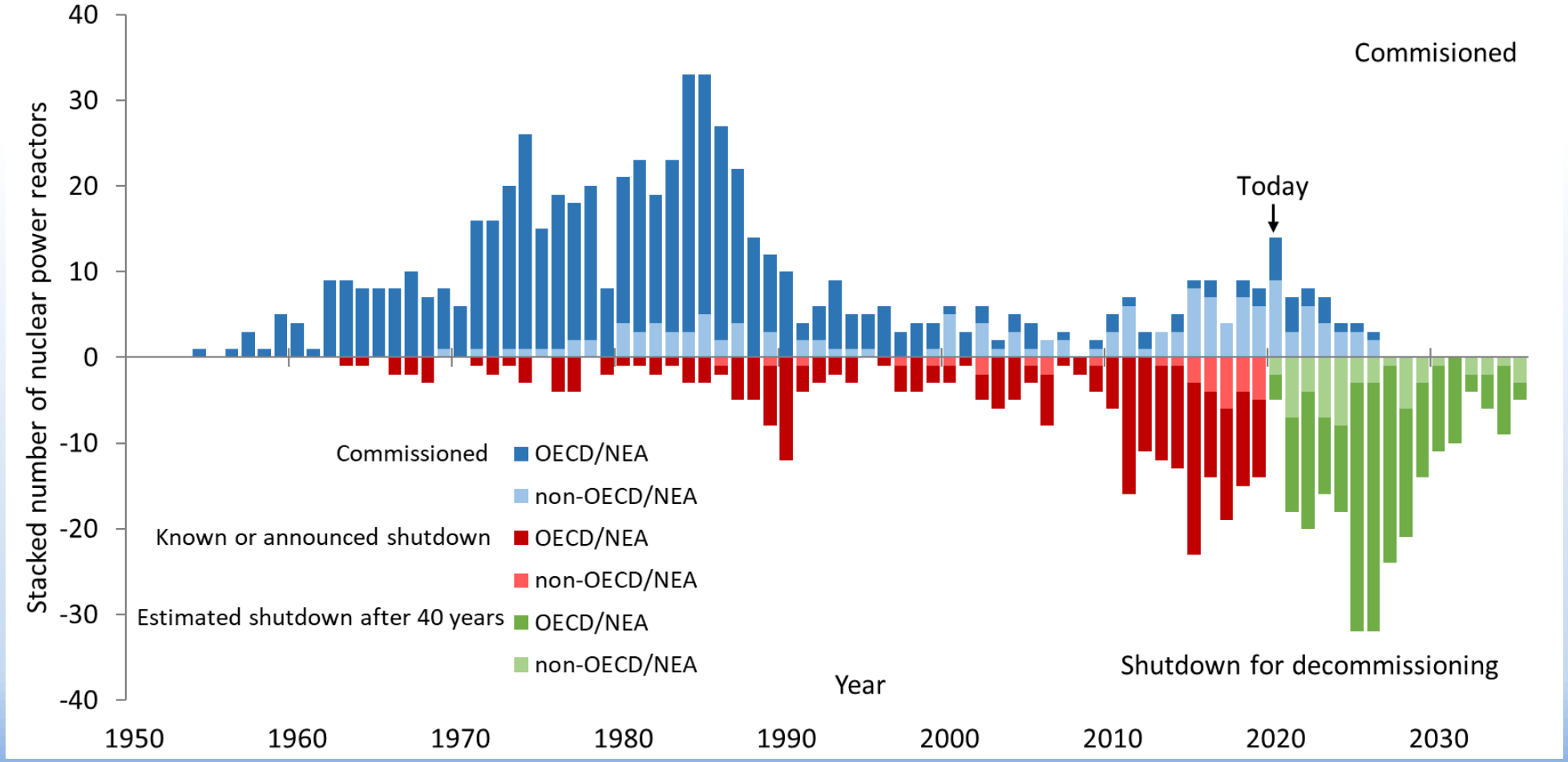
Working Party on Decommissioning and Dismantling (WPDD)

2018

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

Global Nuclear Power Plant Developments

Significant number of nuclear power plants will reach the end of their operating lives in the coming decade or so, or will be shut down for economic or other reasons.



Recent Development in the RWMD

Radioactive Waste Management Committee (RWMC)

Regulators' Forum (RF)

Forum on Stakeholder Confidence (FSC)

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

Joint Project

CPD

Co-operative Programme for the Exchange of Scientific and Technical Information on Nuclear Installation De-commissioning Projects (CPD)

Integration Group for the Safety Case (IGSC)

- Working Group on the Characterisation, the Understanding and the Performance of Argillaceous Rocks as Repository Host Formations (Clay Club)
- Expert Group on Repositories in Rock Salt Formations (Salt Club)
- Expert Group on Geological Repositories in Crystalline Rock Formations – Crystalline Club (CRC)
- Expert Group on Operational Safety (EGOS)

Expert Group on the Application of Robotics and Remote Systems in the Nuclear Back-end (EGRRS)

Expert Group on Building Constructive Dialogues between Regulators and Implementers in Developing Disposal Solutions for Radioactive Waste (RIDD)

Working Party on Information, Data and Knowledge Management (WP-IDKM)

- Expert Group on a Data and Information Management Strategy for the Safety Case (EGSSC)
- Expert Group on Knowledge Management for Radioactive Waste Management Programmes and Decommissioning (EGKM)
- Expert Group on Archiving for Radioactive Waste Management Activities (EGAR)
- Expert Group on Awareness Preservation after Repository Closure (EGAP)

NEW

Working Party on Technical, Environmental and Safety Aspects (WPTES)

Working Party on Management and Organisational Aspects (WPMO)

- Expert Group on Costing for Decommissioning of Nuclear Installations and Legacy Management (EGCDL)

Expert Group on Holistic Process for Decision Making on Decommissioning and Management of Complex Sites (HDCS)

New Groups in the RWMC

- **Working Party on Information, Data and Knowledge Management (WP-IDKM)**
  - Expert Group on a Data and Information Management Strategy (EGSSC)
  - Expert Group on Knowledge Management for Radioactive Waste Management Programmes and Decommissioning (EGKM)
  - Expert Group on Archiving for Radioactive Waste Management Activities (EGAR)
  - Expert Group on Awareness Preservation after Repository Closure (EGAP)
- **Expert Group on the Application of Robotics and Remote Systems in the Nuclear Back-end (EGRRS)**
  - Ad-hoc group on the status of current technologies and usage
  - Ad-hoc group on barriers and impediments
  - Ad-hoc group on cost-benefit analysis

Notable CDLM Milestones

Workshop to determine programme of work

January 2019

April 2019

Bureau Task Group on Structure

Ad-hoc costing Meeting

September 2019

November 2019

Workshop on Legacy Management – Regulatory Framework Optimization

Ad-hoc Meeting on commonalities and specificities between decommissioning and legacy management

December 2019

June 2020

Establishment of:

Expert Group on Costing for Decommissioning of Nuclear Installations and Legacy Management (EGCDL)

Expert Group on a Holistic Process for Decision Making for Decommissioning and Management of Complex Sites (HDCS)

Working Party on Management and Organisational Aspects (WPMO)

Scope proposals (not limiting):

- programme and project management
- cost and funding issues
- supply chain considerations
- societal impact, communication, people and organisational structures.
- knowledge management and record keeping
- education and training of staff

Working Party on Technical, Environmental and Safety Aspects (WPTES)

Scope proposals (not limiting):

- Risk impacts (worker, public, environment safety)
- Sampling and characterization
- Decontamination and Decommissioning Technologies
- Waste streams/roots
- Post Operational Clean out
- Innovative techniques (robotics, digitalization, etc.)

Expert Group on Costing for Decommissioning of Nuclear Installations and Legacy Management (EGCDL)

- **Date of creation of its Mandate : June 1, 2020**
- **EGCDL Kick-Off Meeting – September 28, 2020**

1. To foster exchange of information and experience between its members on issues concerned with cost estimation;
2. To describe good practices in the field of cost estimation for decommissioning and legacy management projects;
3. To advise the CDLM on major and emerging issues in the area of cost estimation for decommissioning and legacy management;
4. To define, conduct and oversee studies aimed at improving the transparency and reproducibility of cost estimates, including approaches to presentation and reporting estimates.

Expert Group on Holistic Process for Decision Making on Decommissioning and Management of Complex Sites (HDCS)

- **Date of creation of its Mandate : June 25, 2020**
- **HDCS Kick-Off Meeting – November 13, 2020**
- **The HDCS will develop a holistic process for decision-making and provide guidelines to allow an integral progression from recognition to resolution to decommission and manage complex sites as a CDLM third-level expert group.**

1. To develop a reliable, effective and efficient process that identifies, assesses, controls and manages risk (societal, economic, environmental) associated with decommissioning and legacy management of complex sites.
2. To develop guidelines and identify needed decisions on how to implement this process.

Regulatory Forum

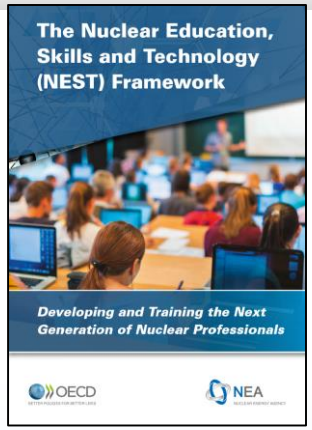
- To enhance collaboration amongst regulators in the area of radioactive waste management, decommissioning and legacy management,
- To better understand the different regulatory and licensing issues in radioactive waste management, decommissioning and legacy management,
- To increase the visibility of regulators in the field of radioactive waste management, decommissioning and legacy management,
- To enhance communication among regulators in other nuclear areas (e.g. nuclear safety).

OECD
BETTER POLICIES FOR BETTER LIVES

Nuclear Energy Agency

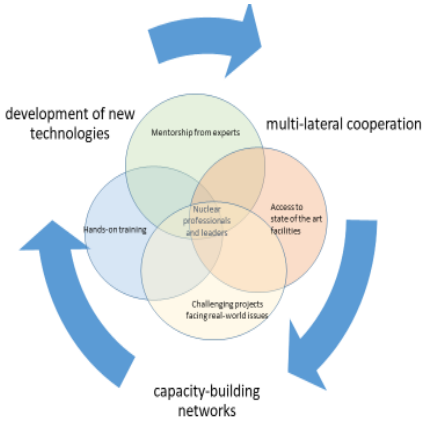
NEA
NUCLEAR ENERGY AGENCY

Nuclear Education, Skills and Technologies (NEST)



A multinational framework to maintain & build skills and to nurture the next generation of nuclear subject matter experts through transfer of practical experience and knowledge

- *The current **NEST Countries** are Belgium, Canada, France, Germany, Italy, Japan, Korea, Russia, Switzerland and USA.*
- ***International cooperation** allows access to a critical mass of capacities (infrastructures, construction projects, decommissioning activities) available within the NEST membership to **NEST Fellows.***



Aims and benefits:

- Develop ***skills and competences*** and ***transfer knowledge*** specific for the nuclear sector through hands-on training activities related to challenging nuclear projects and activities.
- Foster ***human capacity- building networks*** where the next generation of nuclear leaders and professionals could flourish.
- Create added-value for each country by promoting the creation of ***new ideas and technologies*** and ***addressing common challenges.***
- Build a ***talent pipeline*** from universities, to industries, to regulators and technical safety organisations (TSO)

Projects and Criteria:

-***Multinational*** - include at least 3 NEST countries
-Address concrete *and* ***multidisciplinary*** challenges in the field of nuclear science, technology and applications
-Offer ***hands-on*** training opportunities in the field of nuclear science, technology and applications to NEST **fellows**
-Strengthen ***university nuclear education programmes***

57 Organisations

208 Fellows
-13 in 2019-2020

www.oecd-nea.org/nest

NEA-China Forum on Nuclear Decommissioning and Radioactive Waste Management

NEA
NUCLEAR ENERGY AGENCY

中华人民共和国国家原子能机构
China Atomic Energy Authority

18-21 May 2021, Beijing, China

- **Site visit**
  - China Institute of Atomic Energy (CIAE), China Institute for Radiation Protection (CIRP)
- **Participants**
  - 20 speakers/Chairs from NEA and its member countries; 1 speaker from the IAEA
  - 13 speakers/Chairs and 60 senior experts from China
- **Registration**
  - Open: 15 September 2020; Deadline: 15 December 2020

Thank you.

Item 7.2

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

Martin Macášek

CPD Chair

EU-H2020-SHARE Decommissioning Workshop
December 1st-3rd, 2020

NEA Co-operative Programme for Decommissioning

Full official name: Co-operative Programme for the Exchange of Scientific and Technical Information on Nuclear Installation Decommissioning Projects (CPD)

- Established as a Joint-undertaking under Article 5 of the NEA statute in 1985
- The oldest programme on decommissioning of nuclear facilities at OECD-NEA
- Programme is for decommissioning project implementers only
  - ✓ NPPs, Research Reactors, Fuel Cycle Facilities, Industrial Facilities
  - ✓ Programme is focused on technical and pragmatic aspects, based on actual hands-on/off experience

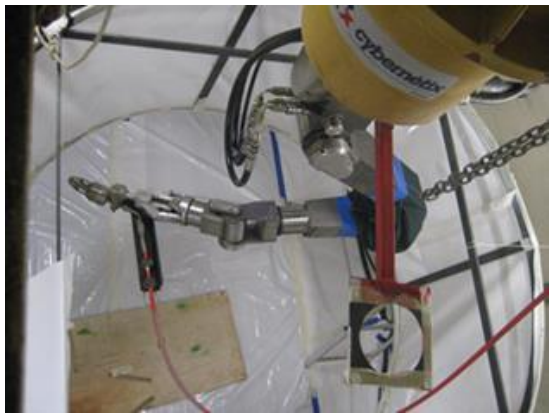
CPD Governance

CPD Management Board

- ✓ Overall responsibility for the **management and control** of the CPD and for ensuring **compliance with the scope and objectives of the Agreement**
- ✓ One meeting per year

Technical Advisory Group (TAG)

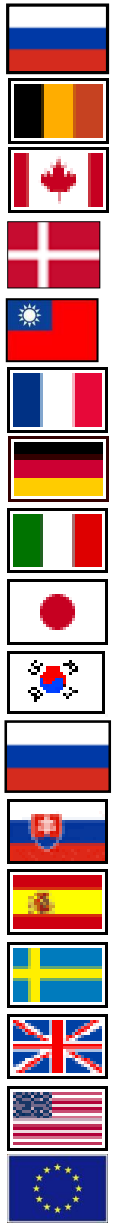
- ✓ Main forum for the open presentation and discussion of new processes, techniques, tools and experiences
- ✓ Two meetings per year



Current CPD-membership

- ✓ Total Decommissioning projects 77 from 28 organisations (historically)

- ✓ Currently active: 56 projects from 28 organisations:
  - 33 NPP's and Research Reactors
  - 23 Fuel Cycle Facilities

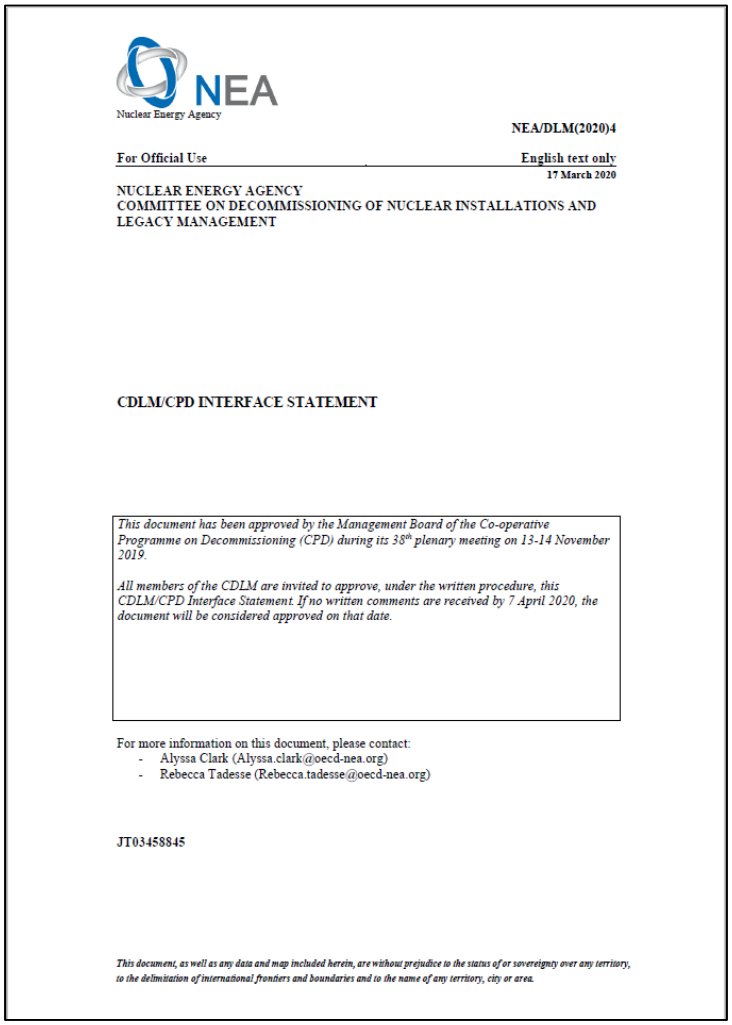


CDLM-CPD Interface Statement

- **Approved by CPD in November 2019;**
- **Approved by CDLM on April 7th, 2020.**

- Collaboration is being implemented through attendance of CPD members to CDLM workshops, meetings etc. and vice versa.

- Request for specific official information would go through established contact points, in order to correctly address them to the owner of the information: only the owner can decide if it agrees to share/public its information



NEA
Nuclear Energy Agency

NEA/DLM(2020)4

For Official Use — English text only

17 March 2020

NUCLEAR ENERGY AGENCY
COMMITTEE ON DECOMMISSIONING OF NUCLEAR INSTALLATIONS AND LEGACY MANAGEMENT

CDLM/CPD INTERFACE STATEMENT

This document has been approved by the Management Board of the Co-operative Programme on Decommissioning (CPD) during its 38th plenary meeting on 13-14 November 2019.

All members of the CDLM are invited to approve, under the written procedure, this CDLM/CPD Interface Statement. If no written comments are received by 7 April 2020, the document will be considered approved on that date.

For more information on this document, please contact:
- Alyssa Clark (Alyssa.clark@oecd-nea.org)
- Rebecca Tadesse (Rebecca.tadesse@oecd-nea.org)

JT03458845

This document, as well as any data and map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Activities of Technical Advisory Group

- 2 TAG meetings in 2019 (2020 – as peculiar as for anybody else):
  - TAG-66 in Winnipeg, Canada, May 13th-17th 2019
    - Topical Session – "Tools used during remote controlled dismantling"
  - TAG-67 in Ispra, Italy, 07th-11th October 2019
    - Topical Session – "Lessons Learned by the different TAG projects"

Thank you

R&D activities for decommissioning of the Fukushima Daiichi NPS

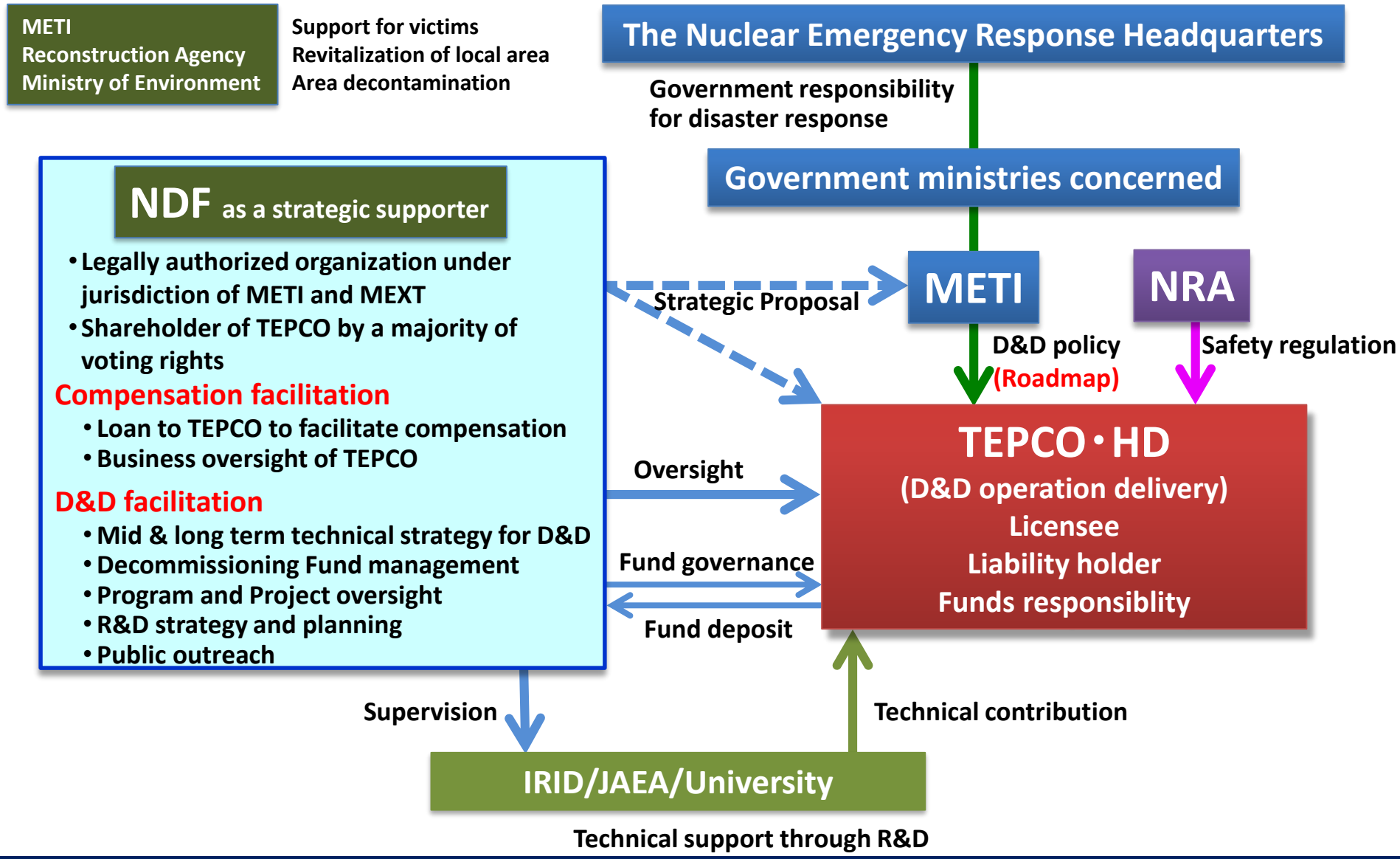
December 1, 2020

Takaki Tsujimoto

Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF)

Table of Contents

Organizational Structure Addressing 1F Decommissioning



Current Situation of the Fukushima Daiichi NPS(1/2)

Unit 1

- Unit 1 was in operation when the earth-quake occurred in March 11,2011.
- The control rods were put into the reactor and the operation was stopped.
- Due to the tsunami, Unit 1 lost electricity, so it could not cool down itself. Hydrogen explosion made Unit 1 lose the function to confine the radioactive materials.
- Toward the removal of SF, TEPCO is cleaning up the rubbles in Unit 1 to prevent the dust from scattering.

At the time of the accident

Now

※ Source: TEPCO

Unit 2

- Unit 2 was in operation when the earth-quake occurred in March 11, 2011.
- The control rods were put into the reactor and the reactor stopped.
- The tsunami made the Unit 2 fail to cool down the reactor itself.
- Hydrogen explosion did not occur.
- To remove SF, TEPCO has decided not to dismantle the building.

At the time of the accident

Now

※ Source: TEPCO

Current Situation of the Fukushima Daiichi NPS(2/2)

Unit 3

- Unit 3 was in operation when the earthquake occurred in March 11,2011.
- The control rods were put into the reactor and the operation was stopped.
- Due to the tsunami, Unit 3 lost electricity, so it could not cool down itself. Hydrogen explosion made Unit 3 lose the function to confine the radioactive materials.

At the time of the accident

Now

- TEPCO has started to remove SF (spent fuel from spent fuel pool) from April 2019.

※ Source: TEPCO

Unit 4

- Unit 4 was not in operation due to the periodic inspection when the earthquake occurred in March 11,2011.
- There were no fuels in the reactor. There were 1,535 SFs in the pool next to the reactor (building
- Hydrogen explosion was caused by the hydrogen in-flow from Unit 3
- TEPCO reduced risks significantly by removing all the SF in the pool in December, 2014.

At the time of the accident

Now

※ Source: TEPCO

Mid-and-Long-Term Roadmap(The Japanese Government)(1/3)

Key points of the revised "the Mid-and-Long-Term Roadmap"

- **Setting out a basic principle of "coexistence of reconstruction and decommissioning",** while there has been gradual progress of **residents' return** and **reconstruction efforts** in surrounding area.
  (giving priority on early risk reduction and ensuring safety)
  - **Coexist with local communities.**
  - **"Optimize the whole decommissioning tasks", by reviewing the work process of 10 years.**
- **Total period of decommissioning is unchanged: "within 30-40 years"**

(1) Fuel debris retrieval

Determine first implementing Unit and the method for fuel debris retrieval.
Start trial retrieval at Unit 2 within 2021, by partial submersion method and side access
The scale of the retrieval will be gradually enlarged.

(2) Fuel removal from pool

Change in the methods to suppress the dust dispersion at Unit 1 and 2
Postpone fuel removal **for 4-5 years at Unit 1**, and **for 1-3 years at Unit 2**
Aim at the completion of fuel removal from all Units 1-6, within 2031

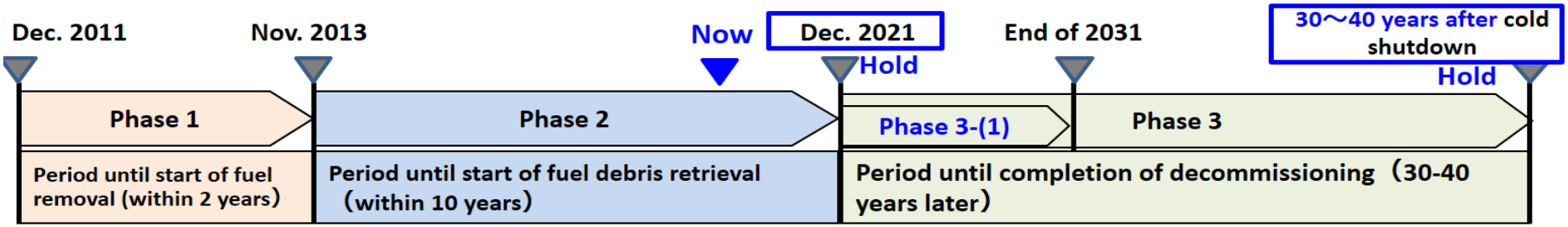
(3) Contaminated water management

- The volume of contaminated water generated has been significantly suppressed.
  ($540m^3$/day (May 2014) → $170m^3$/day (average of FY2018))

Keep current target of reducing the contaminated water generation **to $150m^3$/d within 2020.**
Set new target of reducing the contaminated water generation **to $100m^3$/d within 2025.**
* Handling of ALPS treated water will be continuously discussed in a comprehensive manner

Mid-and-Long-Term Roadmap(The Japanese Government)(2/3)

Major milestones of Mid-and-Long-Term Roadmap (Dec. 2019)



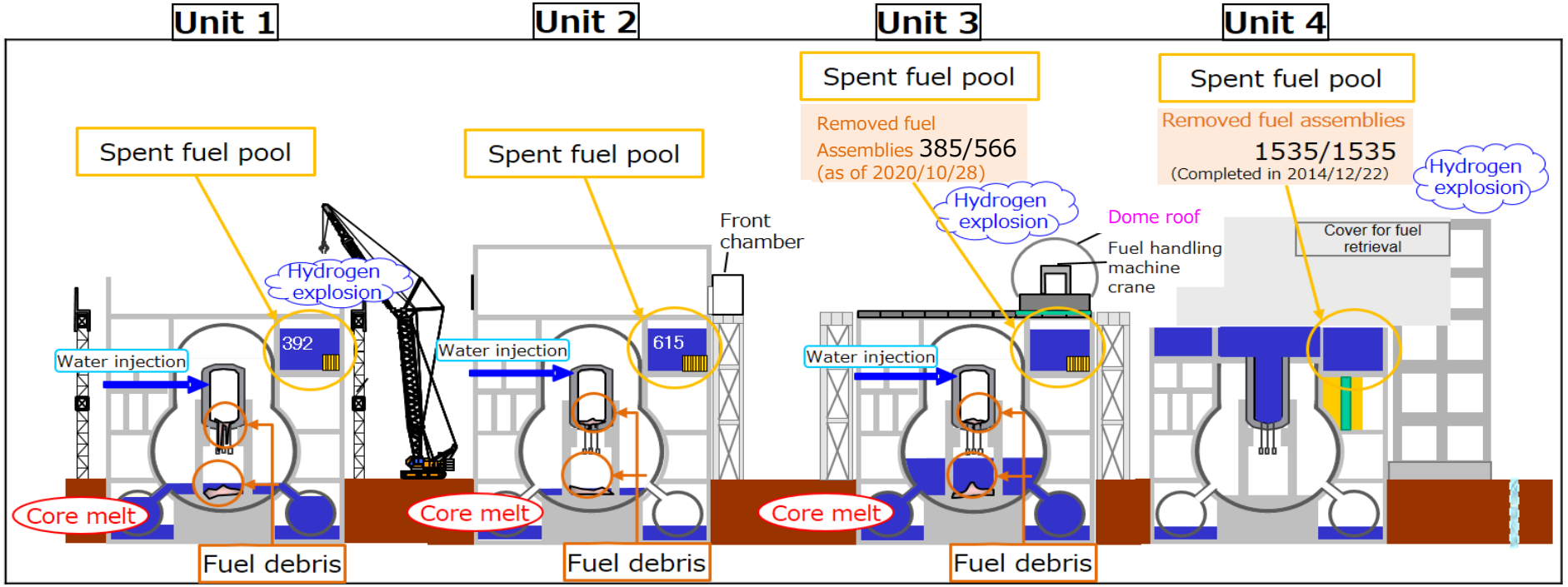
Major milestones

		Roadmap (Sept. 2017)	Revised Roadmap	
Contaminated water management	Reduce to about 150 m^3/day **Reduce to about 100m^3/day or less** (Further reduction of generation)	Within 2020 —	Within 2020 **Within 2025**	NEW
Stagnant water treatment	Complete stagnant water treatment in buildings*	Within 2020	Within 2020(*)	
	Reduce the amount of stagnant water in buildings to about a half of that in the end of 2020	—	**FY2022 - 2024**	NEW
Fuel removal	**Complete of fuel removal from Unit 1-6**	—	**Within 2031**	NEW
	Complete of installation of the large cover at Unit 1	—	**Around FY2023**	NEW
	Start fuel removal from Unit 1 (Methods have changed to ensure safety and prevent dust scattering)	Around FY2023	**FY2027 – 2028**	REVISED
	Start fuel removal from Unit 2	Around FY2023	**FY2024 - 2026**	REVISED
Fuel debris retrieval	Start fuel debris retrieval from the first Unit (Start from Unit 2, expanding the scale gradually)	Within 2021	Within 2021	
Waste management	Technical prospects concerning the processing/disposal policies and their safety	Around FY2021	Around FY2021	
	Eliminating temporary storage areas outside for rubble and other waste	—	**Within FY2028**	NEW

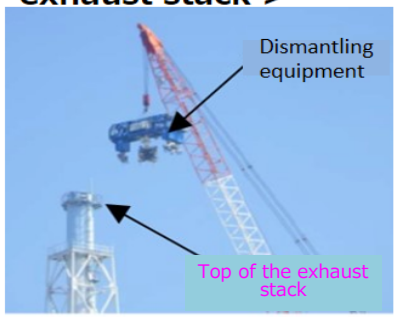
* Excluding the reactor buildings of Units 1-3, process main buildings, and High temperature incineration building.

Mid-and-Long-Term Roadmap(The Japanese Government)(3/3)

Current status of Unit 1-4 of Fukushima Daiichi NPS

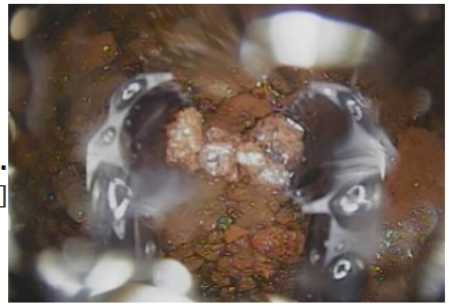


<Dismantling of Unit 1/2 exhaust stack >



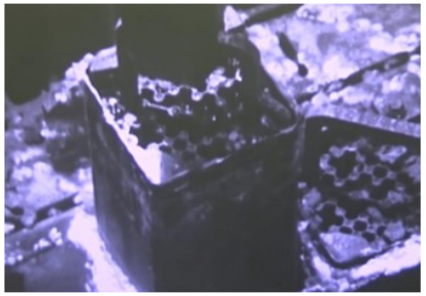
Local company joins as a prime contructor. [Aug. 2019]

<Fuel debris retrieval>



Confirmed that the deposit likely to be the fuel debris was able to be gripped and moved. (Unit 2) [Feb. 2019]

<Fuel removal>



Started fuel removal from spent fuel pool by remote control, for the first time from a nuclear reactor with core melt (Unit 3) [Apr. 2019]

R & D activities for the Fukushima Daiichi NPS

■ Formulation of R&D medium-to-long-term plan

✓ By formulating new medium-and-long-term R&D plan and developing the next-term R&D plan based on it, **it will be clarified how and where each research and development project corresponds to the decommissioning process.** The plan will be **updated and expanded every year**.

■ Enhancement of R&D system in the government-led R&D program on decommissioning and contaminated water management

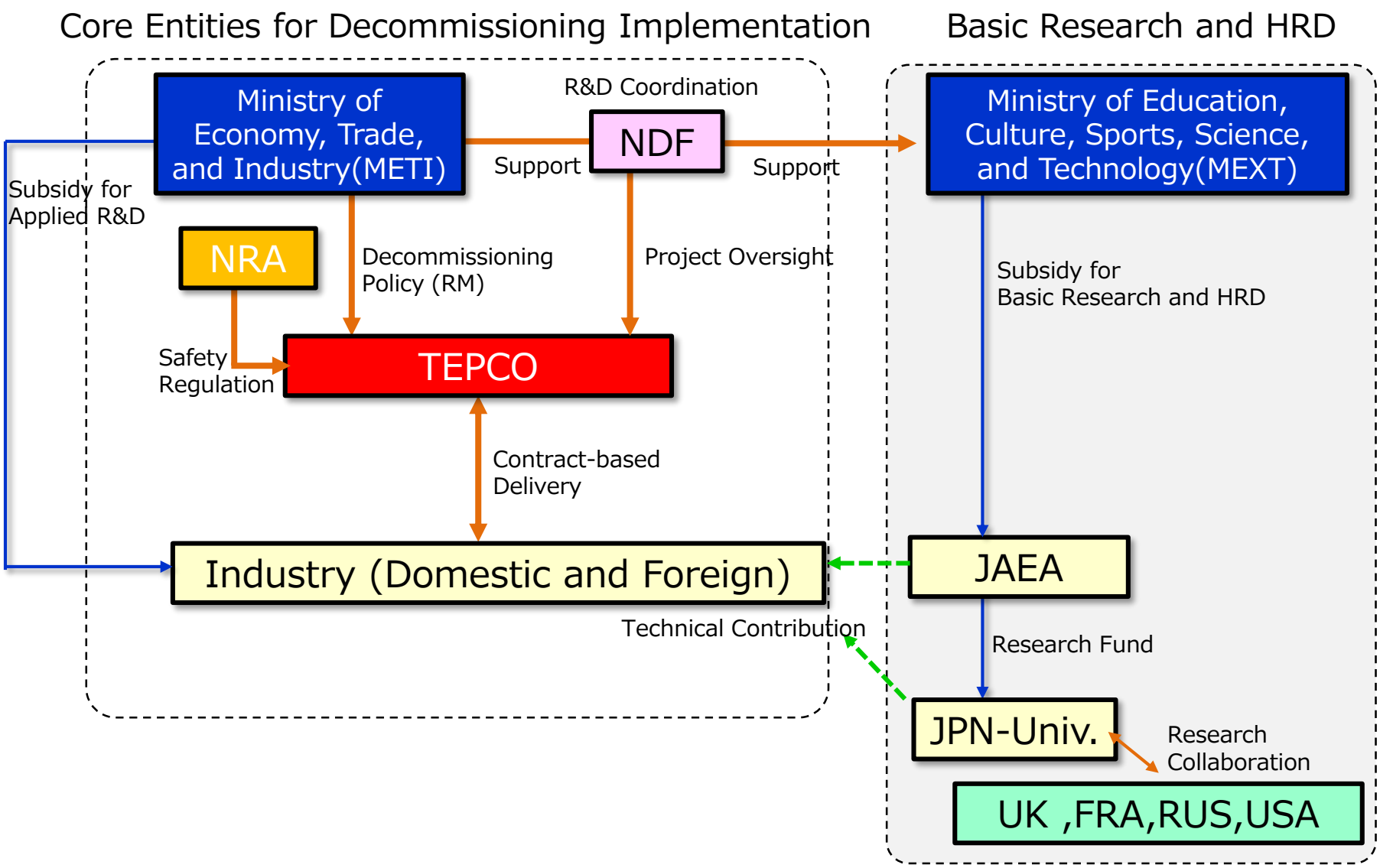
✓ Trial retrieval in 2021 is approaching. Soon thereafter, for expanding the retrieval scale, **the structure was enhanced** as we recognized **the need to accelerate R&D**.

■ Alignment of needs and seeds between decommissioning work sites and universities or research institutions

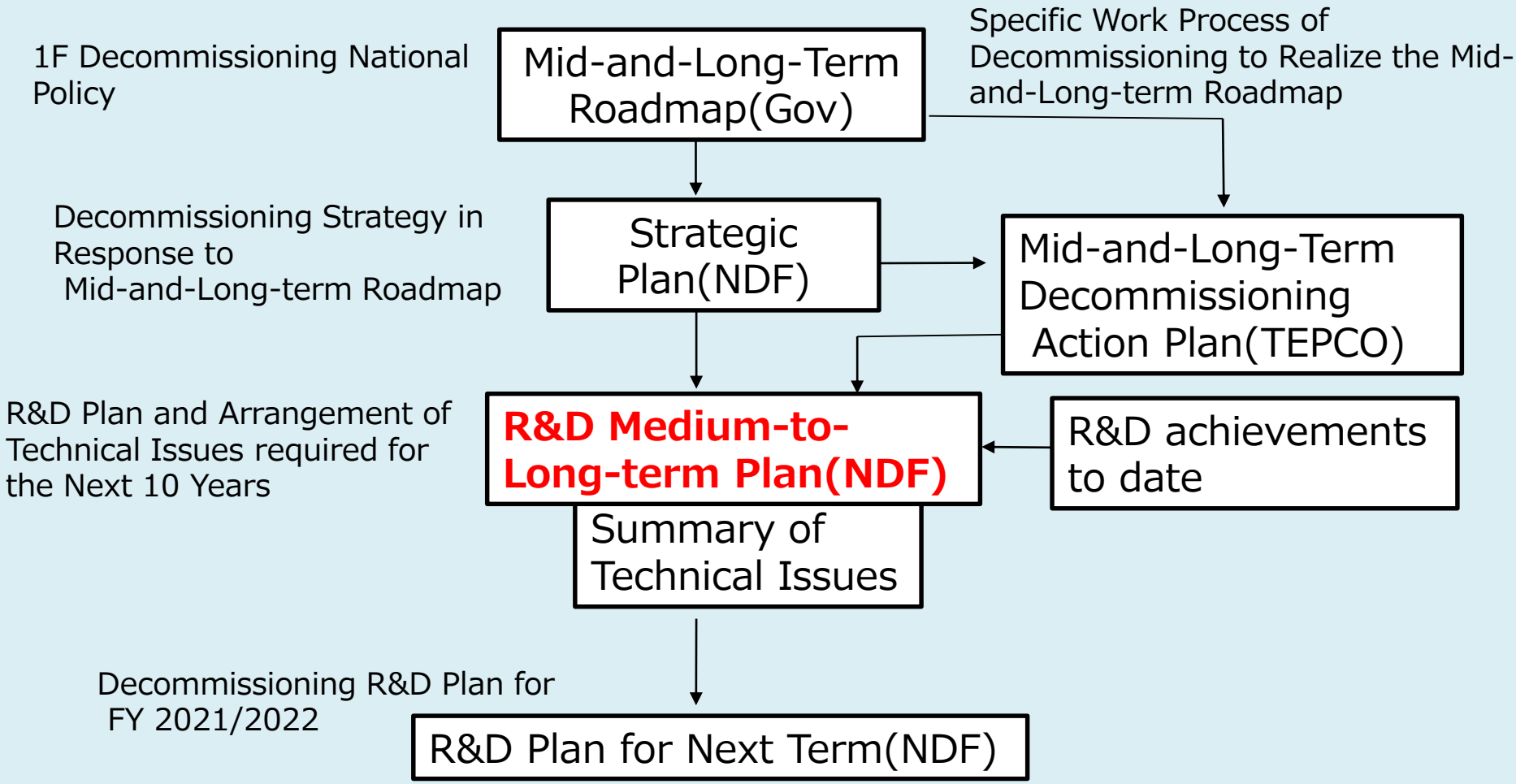
✓ Up to date, good results have been obtained from the world intelligence projects of MEXT and JAEA, and **reflected in the decommissioning work sites.**

✓ **New joint researches between TEPCO and four universities in Japan have started** last year. Thus, continuous enhancement of collaboration with related institutions is needed.

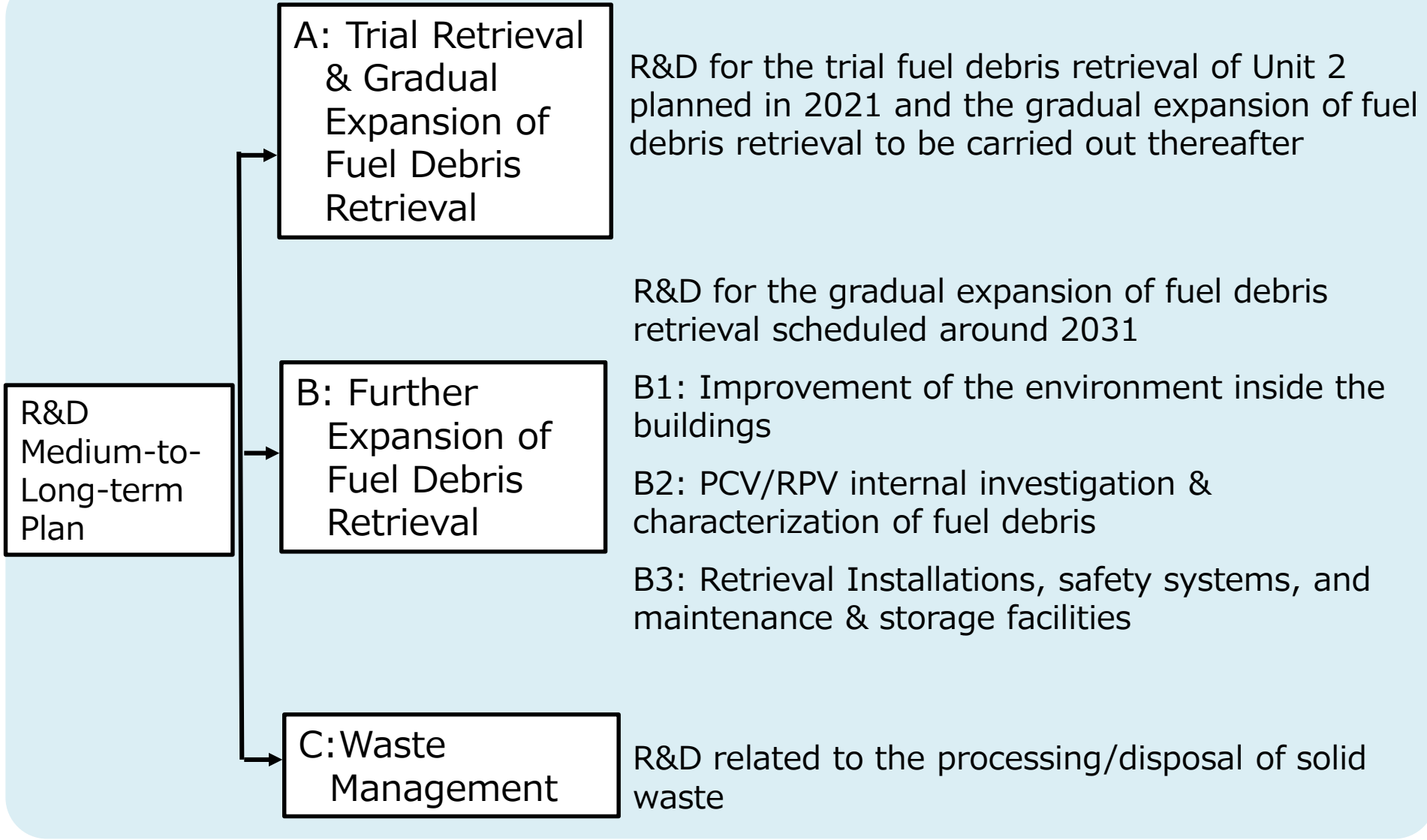
Outline of the R&D implementation system for the decommissioning of the Fukushima Daiichi NPS



Formulation of R&D Medium-to-Long-term Plan for the Next 10 Years

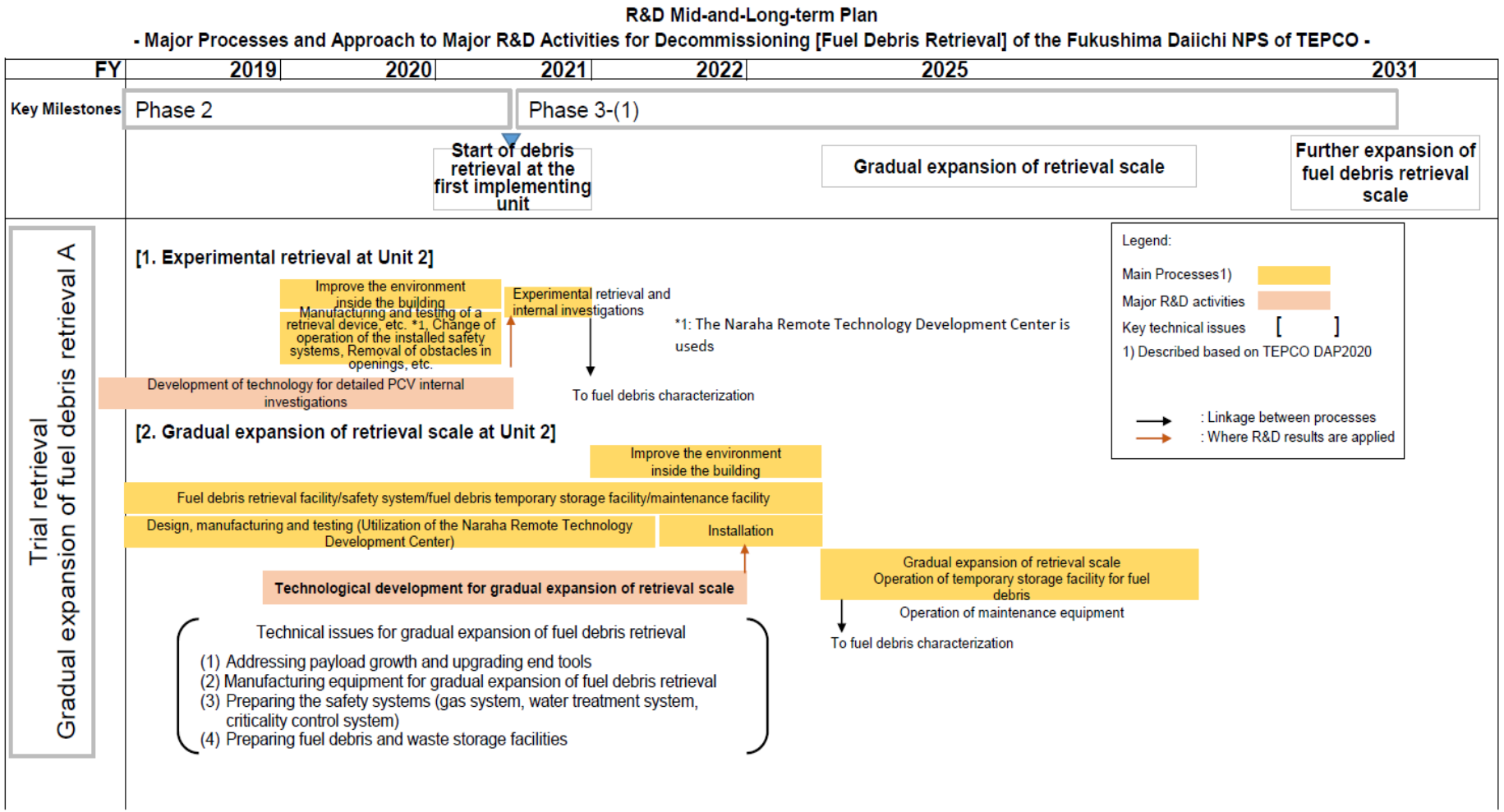


Summary of R&D Medium-to-Long-term Plan

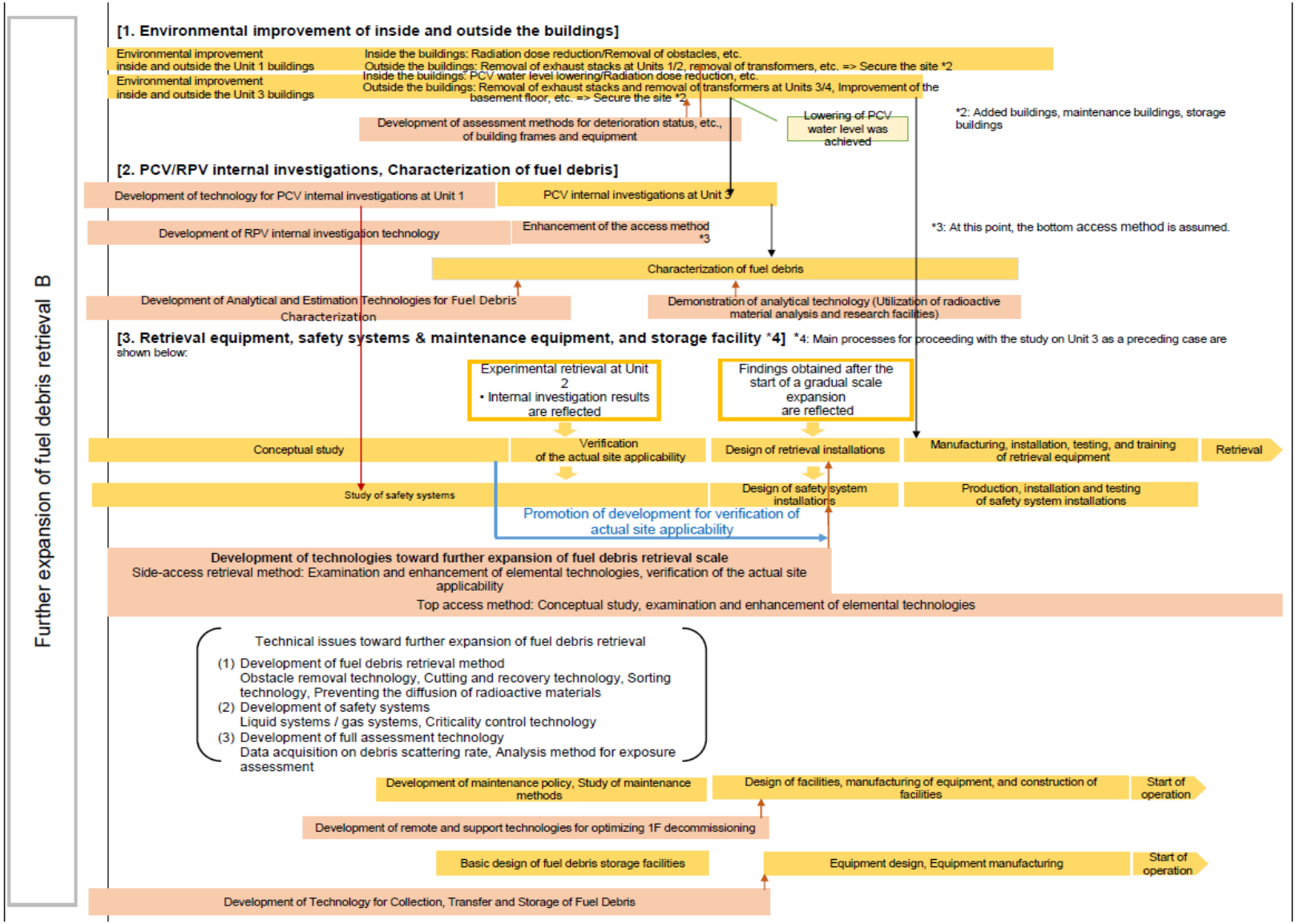


R&D Medium-to-Long-term Plan (A)

[Published edition/For discussions among stakeholders]



R&D Medium-to-Long-term Plan (B)



Thank you for your attention!

If you need more information about NDF activities, please visit our website for details. (English pages)

http://www.dd.ndf.go.jp/en/about/index.html

SNETP
Sustainable Nuclear Energy Technology Platform

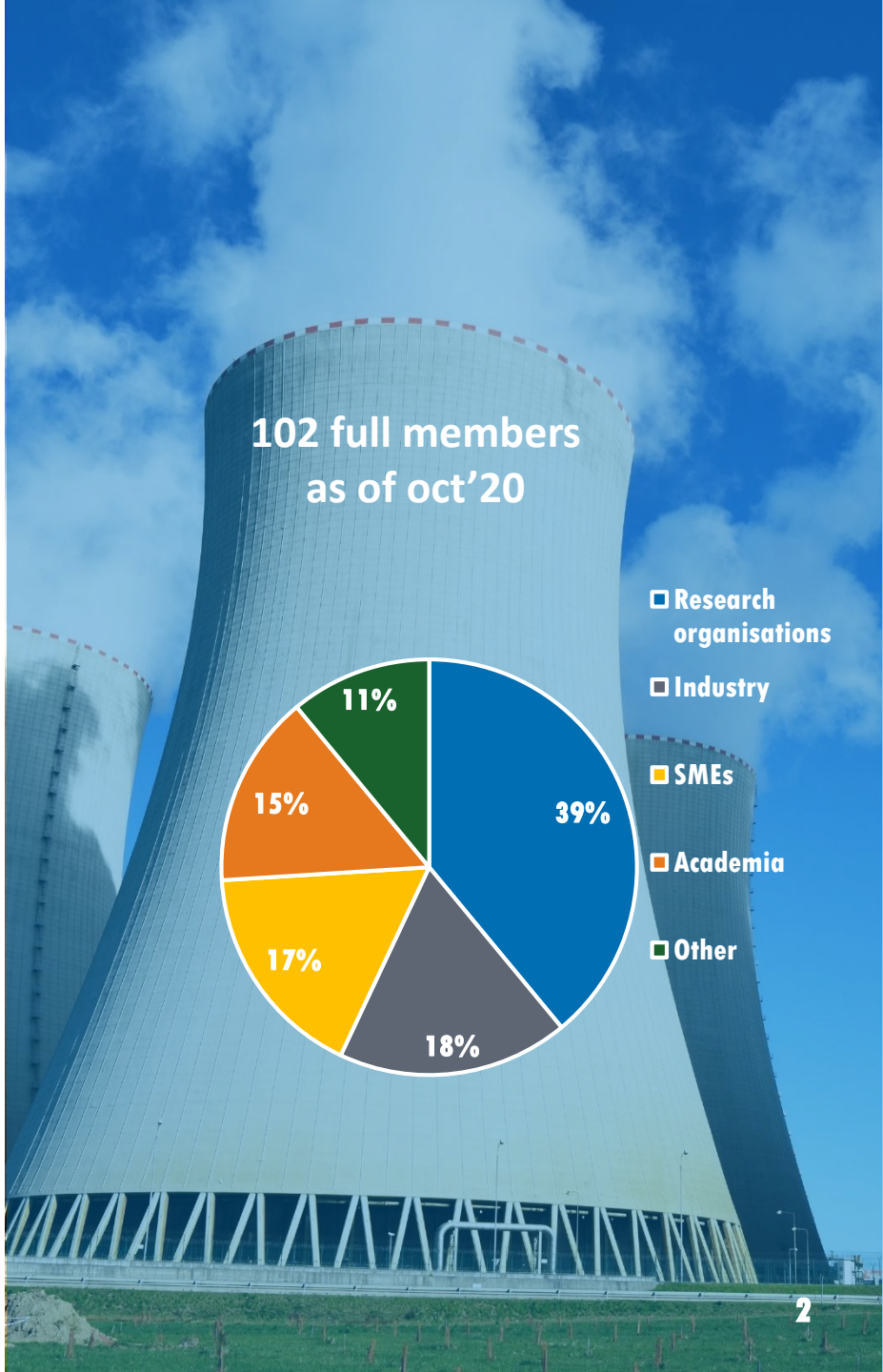
SNETP Association

A. Al Mazouzi (EDF)

General Secretariat

SNETP in a nutshell

- SNETP was set up in 2007 under the auspices of the European Commission with the goal to **support technological development for enhancing safe and competitive nuclear fission in a climate-neutral and sustainable energy mix**.
- In line with the objectives of the SET-Plan, SNETP aims to contribute to:
  - Lowering European greenhouse gas emissions
  - Assuring security of energy supply for Europe
  - Stabilizing electricity prices in Europe
- The association gathers various types of stakeholders: industry, research centres, safety organisations, universities, non-governmental organisations, SMEs, etc.

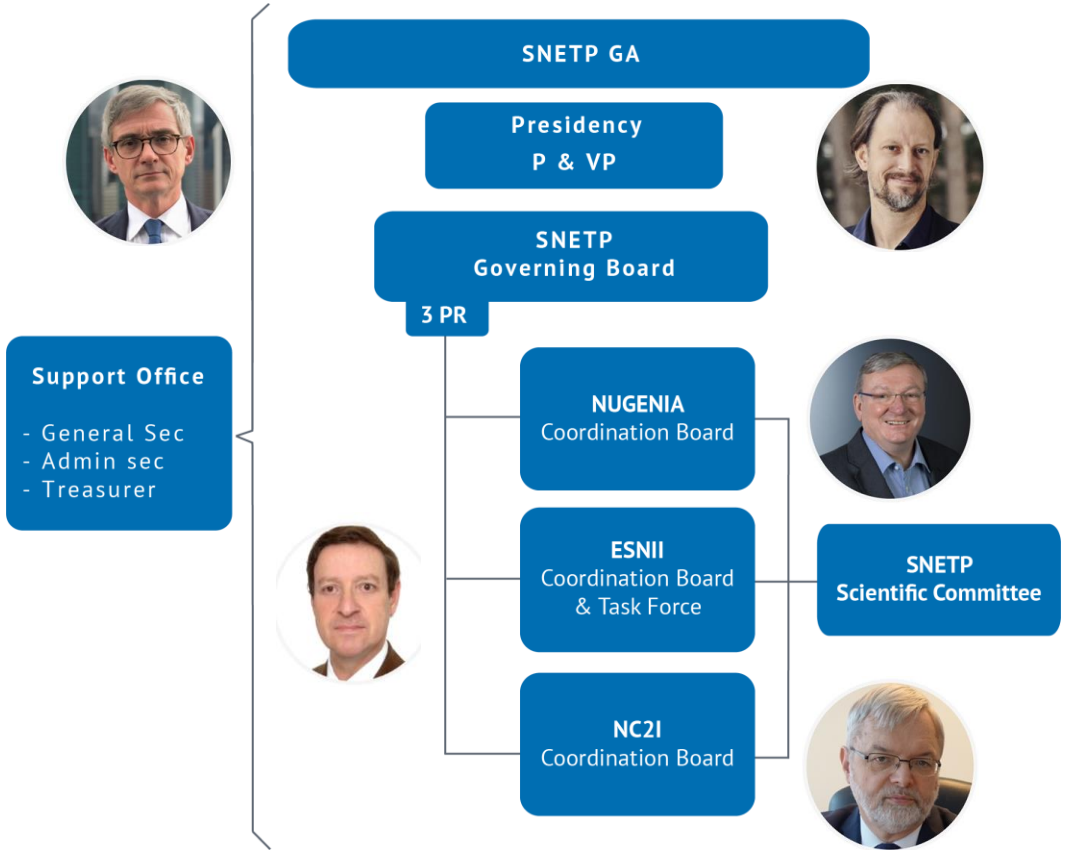


SNETP
Sustainable Nuclear Energy Technology Platform

Who is SNETP?


AFRY
ANSALDO NUCLEAR
ARTTIC
axpo
BELV
Nuclear Research Centre
BECKER TECHNOLOGIES
bay
cea
CEIDEN
CHALMERS UNIVERSITY OF TECHNOLOGY
Ciemat
Canadian Nuclear Laboratories
Laboratoires Nucléaires Canadiens
cnrs
Canadian Nuclear Safety Commission
CANDU Owners Group Inc.
COG
"Strength Through Co-operation"
CRIEPI
Central Research Institute of Electric Power Industry
CENTRO TECNOLÓGICO CT
CVŘ
Centrum výzkumu Řež
CENTRUM PRE VEDU A VÝSKUM
DOOSAN
UNIVERSITÀ DI PISA
EMPRESARIOS AGRUPADOS
European Commission
EDF
EDF ENERGY
ELEXIM
VÉMI
ÉPÍTÉSÜGYI MINŐSÉGELLENŐRZŐ INNOVÁCIÓS NKFT.
ENEA
enen
ENERGORISK
ENGIE
EPRI
ELECTRIC POWER RESEARCH INSTITUTE
FINNUCLEAR
FORATOM
THE VOICE OF THE EUROPEAN NUCLEAR INDUSTRY
fortum
framatome
Fraunhofer IZFP
JÜLICH Forschungszentrum
GRS
HZDR
HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF
IBERDROLA
IDOM
IFE
Universität Stuttgart
INAIL
ISTITUTO NAZIONALE PER L'ASSICURAZIONE CONTRO GLI INFORTUNI SUL LAVORO
Inesco ingenieros
INNOMERICS
INRNE
kiwa
IPP CENTRE
IRSN
INSTITUT DE RADIOPROTECTION ET DE SÛRETÉ NUCLÉAIRE
ISSPMT
ivs
Jacobs
JAEA
Jožef Stefan Institute
KAERI
icebco
KIT
Karlsruher Institut für Technologie
Kernkraftwerk Leibstadt
KTH
LABORELEC
GDF SUEZ
LGI
sustainable innovation
LUT University
N.I.N.E.
NUCLEAR AND INDUSTRIAL ENGINEERING
NATIONAL CENTRE FOR NUCLEAR RESEARCH ŚWIERK
NATIONAL NUCLEAR LABORATORY
NRG
nuccon
NUCLEAR AMRC
orano
The Open University
Preussen Elektra
POLITECNICO MILANO 1863
PAUL SCHERRER INSTITUT
PSI
RATEN
REGIA AUTONOMĂ TEHNOLOGII pentru ENERGIA NUCLEARĂ
RISK ENGINEERING LTD.
Rolls-Royce
sck cen
SLOVENSKÉ ELEKTRÁRNE
NUCLEARELECTRICA
S.R.S. Servizi di Ricerche e Sviluppo S.r.l.
SSTC NRS
STATE ENTERPRISE STATE SCIENTIFIC AND TECHNICAL CENTER FOR NUCLEAR AND RADIATION SAFETY
STU FEI
SVTI ASIT
SWERIM
tecnatom
TRUEFLAW
Technische Universität München
TVO
UC UNIVERSIDAD DE CANTABRIA
ÚJV
ktu
prof. kazimieras barsauskas ultrasound research institute
MANCHESTER 1824
The University of Manchester
UPC
UNIVERSITAT POLITÈCNICA DE VALÈNCIA
VATTENFALL
VTT
vúje
VZÚ PLZEŇ
Westinghouse
WORLD NUCLEAR ASSOCIATION
Wölfel
ZAG
SNETP
Sustainable Nuclear Energy Technology Platform

SNETP governance



- The **General Assembly** gathers all members and votes on key decisions.
- The **Presidency** is responsible for the high-level representation of the Association and channels the positions of the General Assembly to external stakeholders.
- SNETP is steered and monitored by a **Governing Board** which is in charge of executing the decisions taken by the General Assembly.
- **GB Committees**
  - Feed the reflection and interactions between meetings
  - Strengthen the association presence at various levels
  - Ensure the subsidiarity of decisions and actions
- Three **pillars** (NUGENIA, ESNII & NC2I) and a Scientific Committee carry out the technical work of the Association.
- The **Support Office** is composed of the General Secretariat, an Administrative Secretariat and a Treasurer.
  - Alain Le Gac: Treasurer
  - Abdou Al Mazouzi: General Secretariat

SNETP
Sustainable Nuclear Energy Technology Platform

Objectives

Promoting Scientific Excellence

- Agree on, implement and promote common R&I priorities within the SNETP community representing the three pillars and strenghten EU expertise and excellence

Boosting Innovation

- Facilitate industrial-driven and intersectoral innovation (digital, robotics, materials, etc.) in nuclear for current and new applications (non-power, hydrogen, etc.)

Representing nuclear fission R&D in European Affairs

- Promote SNETP expertise and research priorities towards European institutions

Strenghtening International Relations

- Promote SNETP expertise and research priorities towards international nuclear institutions (IAEA, OECD/NEA, GIF, etc.)

Providing solutions to Industry

- Foster industrial-driven research addressing the needs of SNETP industrial members in particular regarding safety, supply chain, licensing and cost-competitiveness

Cooperating closely with Regulators

- Reinforce cooperation between SNETP and the different regulatory and standardization bodies.

Supporting R&D infrastructures

- Support projects and initiatives aiming at maintaining/refurbishing/building the needed infrastructure to perform R&D&I in the nuclear field.

Sharing Experience with European Associations

- Fostering & coordinating interactions with European associations in the field of nuclear, and any other sector with potential mutual interests with nuclear.

Engaging with Civil Society

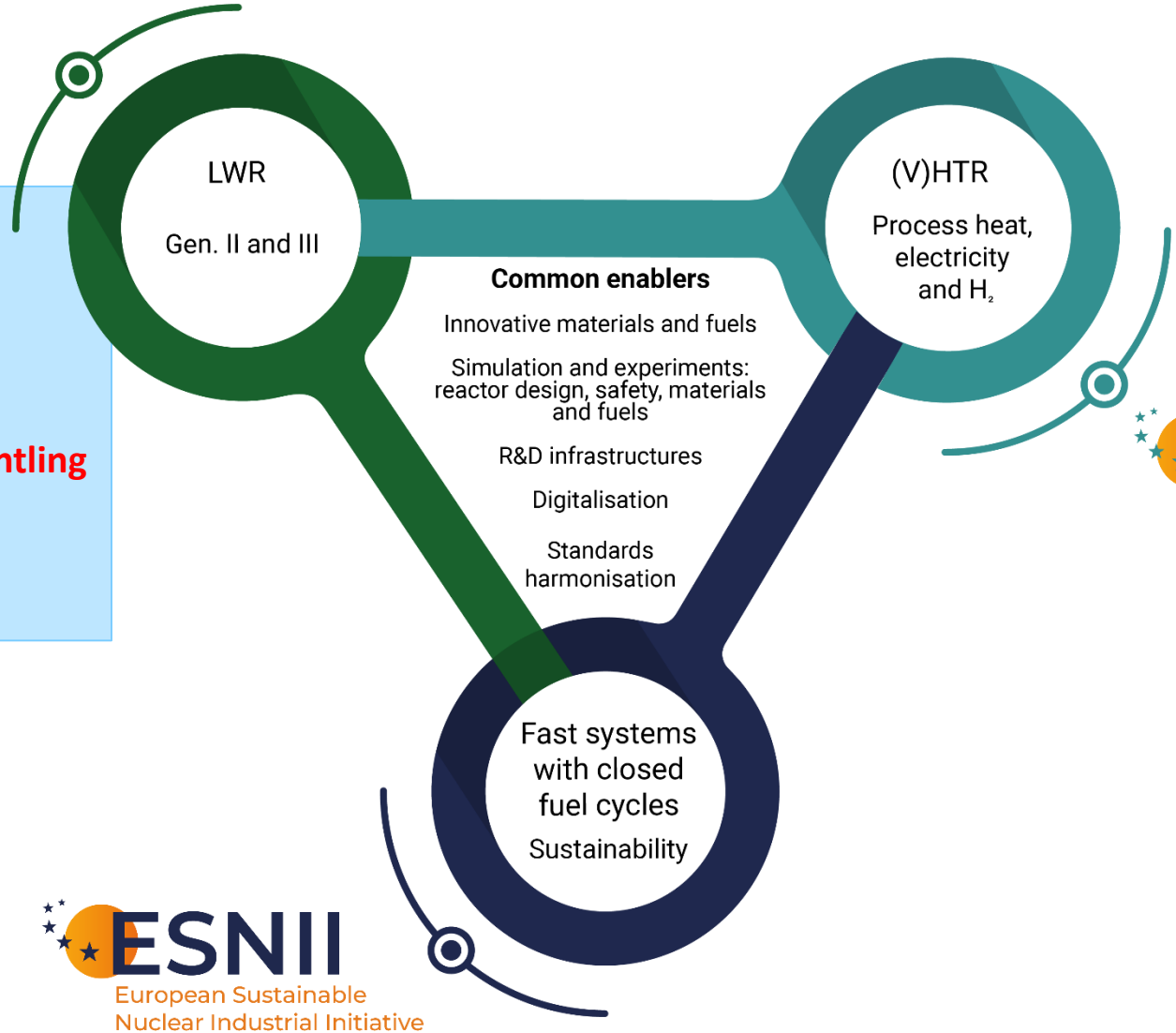
- Engage with civil society and non-nuclear stakeholders to rationalize the debate on the European energy mix and enhance the acceptability of nuclear.

SNETP
Sustainable Nuclear Energy Technology Platform

Three Pillars

NUGENIA
Nuclear Generation II&III Alliance

Technical Areas:
TA1: Safety
TA2: Severe Accident
TA3: reactor performance & Fuel
TA4: Components and structures
TA5: Decommisioning and Dismantling
TA6: Advanced LWR technologies
TA7: Harmonisation
TA8: Inspection & Qualification



NC2I
Nuclear Cogeneration Industrial Initiative

ESNII
European Sustainable Nuclear Industrial Initiative

SNETP
Sustainable Nuclear Energy Technology Platform

Objectives of TA5:

through collaborative R&D projects, we intend:

- To learn from current experience and identify best practice in waste management and decommissioning,
- To enhance decommissioning site safety: integrity of structures prediction, advanced decontamination and associated optimized measurement methods, mobile wireless sensor network).
- To optimize decommissioning scenarios thanks to digitalization: 3D photo acquisition, objects recognition, taking into account “as built” geometries. Organizational aspects such as schedules and resource availability should also be included in the optimization system.
- To develop characterisation techniques for waste inventory assessment and plant and facility assessment to aid planning for decommissioning
- To innovate enhanced decontamination and dismantling technologies for structures and components, incl. remote dismantling techniques
- To establish improved treatment technologies (thermal or other) to reuse/recycle materials, minimise waste volumes and to develop robust and passive waste forms.
- To accelerate the introduction of new technologies and technical approaches through inactive and active demonstrations.
- Minimisation of waste production by design and material selection and operational measures and development of advanced waste treatment and conditioning technologies;
- Waste minimisation strategies for decommissioning, incl. safe release of material to the environment, recycle/reuse, disposal to VLLW repositories (landfills) along with reliable and cost effective activity measurement (assay) techniques
- Organizational aspects: Standardization of processes, Identification of synergy effects for multi-unit sites or fleet-wide D&D projects, optimization of post-operational phase,

SNETP
Sustainable Nuclear Energy Technology Platform

SNETP added value

- **SNETP is the only European wide association dedicated to collaborative nuclear research fostering** the creation of project ideas and **facilitating** their financial support (EC, national, industry, etc.)
  - All major European R&D organisations involved in nuclear are members of the association.
  - Various events are organised and online tools are deployed to facilitate collaboration of the community on new projects proposals. SNETP has supported discussions on approximately 300 project ideas, labelled about 80 of them. More than ½ got financial support to be launched.
- **The specific European Technology & Innovation Platform (ETIP) status provides an important visibility to SNETP and its members**, with privileged access to relevant high-level managers within EU institutions, international organisations, and member states.
- **SNETP and its members contribute to the shaping of European energy policies**, by exchanging with peers on research priority topics, by producing reference documents (e.g. SRIA) on the state of R&D&I in Europe, by publishing position papers, etc.

Contact us

www.snetp.eu

secretariat@snetp.eu

www.linkedin.com/company/snetp

@SNE_TP

SNETP
Sustainable Nuclear Energy Technology Platform

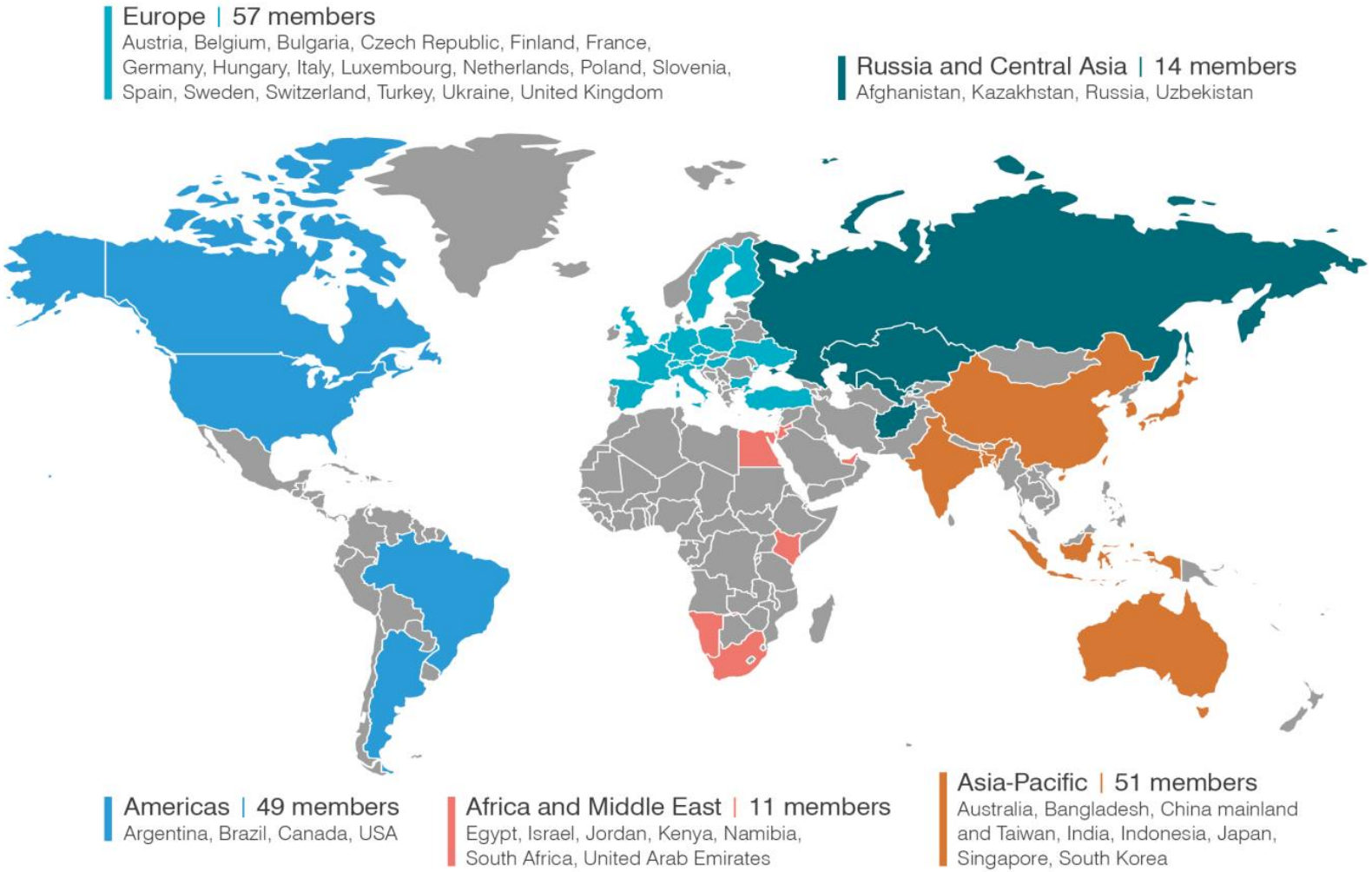
WORLD NUCLEAR ASSOCIATION

World Nuclear Association Presentation & Activities

Dr. M. Pieraccini
Chairman of WNA Waste Management & Decommissioning activities

WNA is the industry international organisation that represents the global nuclear industry

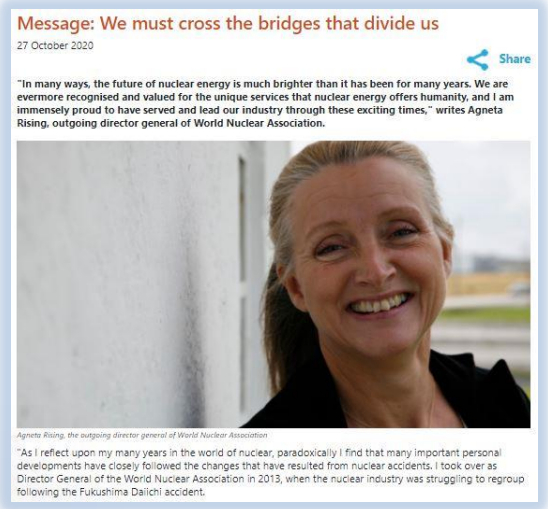
A strong network of 182 member companies from across the world (43 countries)



New Director General assumes office

- Appointment of new WNA Director General : **Sama Bilbao y Leon** (press release and WNN story)

- Agneta Rising's leaving message on World Nuclear News



Message: We must cross the bridges that divide us

27 October 2020

Share

"In many ways, the future of nuclear energy is much brighter than it has been for many years. We are evermore recognised and valued for the unique services that nuclear energy offers humanity, and I am immensely proud to have served and lead our industry through these exciting times," writes Agneta Rising, outgoing director general of World Nuclear Association.

Agneta Rising, the outgoing director general of World Nuclear Association

"As I reflect upon my many years in the world of nuclear, paradoxically I find that many important personal developments have closely followed the changes that have resulted from nuclear accidents. I took over as Director General of the World Nuclear Association in 2013, when the nuclear industry was struggling to regroup following the Fukushima Daiichi accident.

New members

- Four new members since September 2019:

deugro

goliex

INL Idaho National Laboratory

ROSCA SOLUTIONS

- **Five new members in 2020:**

TEPCO

DEEP ISOLATION

HUNTON ANDREWS KURTH

NPPA Nuclear Power Plants Authority

WORLD NUCLEAR ASSOCIATION

Introduction

WNA's goal is to develop industry positions on relevant issues through our various groups

Fuel Cycle Working Groups	Fuel Report • Sustainable Used Fuel Management • Security of the International Fuel Cycle • Transport
Plant Performance Working Groups	Cooperation in Reactor Design Evaluation & Licensing • Supply Chain • Capacity Optimization • Waste Management & Decommissioning
Cross-Cutting Working Groups	Economics • Law • Radiological Protection • Nuclear Innovation Roadmap - NI2050
Advisory Groups	Advisory Panel • Communication Group

Introduction to WNA WM&D
Waste Management & Decommissioning Activities

- ✓ The **WNA WM&D WG monitors** developments **and shapes industry positions** with a view to improving the system of waste management and decommissioning

- ✓ The **WM&D WG is** the industry's interface **with official international institutions** such as the :
  - ✓ IAEA, (Waste Safety Standards Committee (WASSC), WATEC, IDN, …),
  - ✓ OECD/NEA (RWMC, CDLM, RF, FSC, …),
  - ✓ European Commission and its Institutions (Euratom, Foratom, …).

- ✓ The WG cooperates with other WNA WGs on topics such as Radiological Protection of workers during decommissioning, multinational repositories, spent fuel, but also laws & economics.

WNA WM&D Contributions & New publications

- ✓ Contribution to **UNECE 2020 Report** in cooperation with the IAEA
- ✓ 24 September – UNECE session on the role of nuclear energy resources in sustainable development (part of UNECE Energy Week 2020)

- ✓ 12-15 October - Smart Energy Technology Asia 2020 virtual conference (SETA)

- ✓ First of a kind, in-depth, collaboration between OECD-NEA and the Association, co-developing policy briefs and a webinar series.

Four policy briefs on key themes:

- ✓***Building low-carbon*** *resilient electricity* ***infrastructures*** *with nuclear power in the post-COVID era;*
- ✓***Creating high-value jobs and economic development*** *post-COVID-19 – Investing in* ***nuclear energy is key*** *to building* ***cleaner and more resilient societies****;*
- ✓***Unlocking financing for nuclear energy*** *infrastructure in the post-pandemic economic recovery;*
- ✓***Cost-effective decarbonisation*** *of electricity systems and nuclear power.*

Radioactive Waste - Myths and Realities

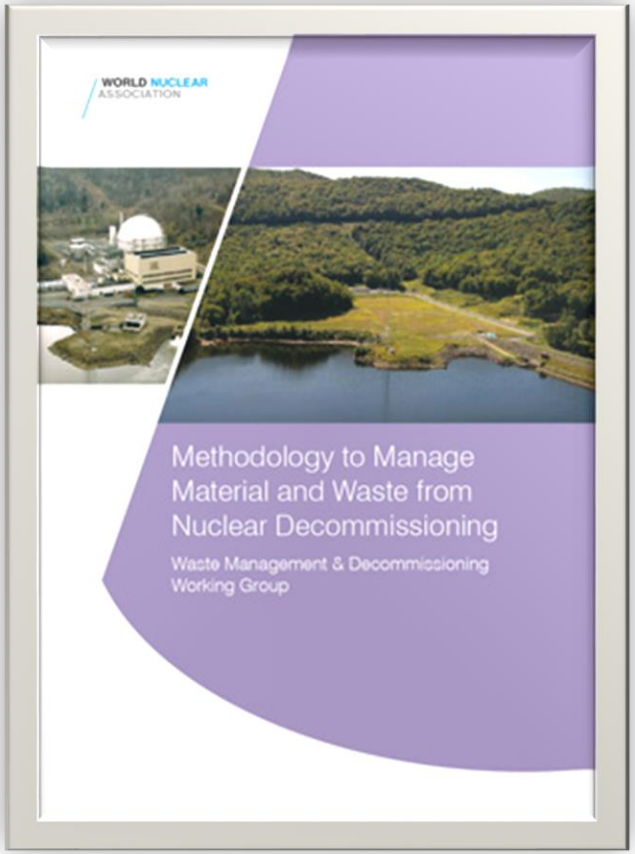
- **There are a number of pervasive myths regarding both radiation and radioactive waste.**
- **Some lead to regulation and actions which are counterproductive to human health and safety.**

Over the years, many views and concerns have been expressed in the media, by the public and other interested groups in relation to the nuclear industry and in particular its waste. Questions have been raised about whether nuclear power should continue when the issue of how to deal with its waste has apparently not yet been satisfactorily resolved.

Some of the more commonly expressed views and concerns include:

1. The nuclear industry still has no solution to the 'waste problem'.
2. The transport of this waste poses an unacceptable risk to people and the environment.
3. Plutonium is the most dangerous material in the world.
4. Nuclear waste is hazardous for tens of thousands of years. This clearly is unprecedented and poses a huge threat to our future generations.
5. Even if put into a geological repository, the waste might emerge and threaten future generations.
6. Nobody knows the true costs of waste management. The costs are so high that nuclear power can never be economic.
7. The waste should be disposed of into space.
8. Nuclear waste should be transmuted into harmless materials.
9. There is a potential terrorist threat to the large volumes of radioactive waste currently being stored and the risk that this waste could leak or be dispersed as a result of terrorist action.
10. Man-made radiation differs from natural radiation.

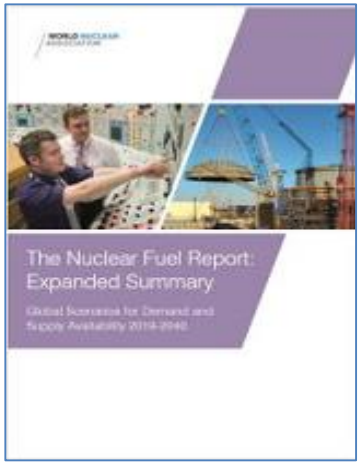
WNA WM&D Activities
Methodology to Manage Material and Waste from Nuclear Decommissioning



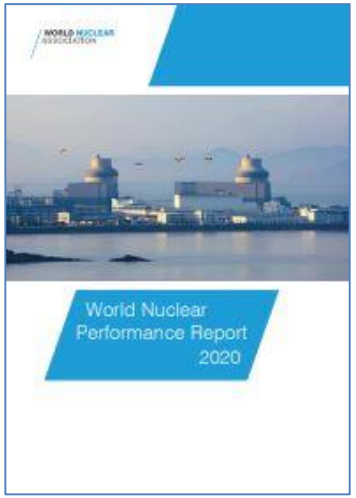
Available to download from the Association website

WNA New publications

- Information papers:
  - COVID-19 Coronavirus and nuclear energy
  - Security of Nuclear Facilities and Material



- Reports:
  - The Nuclear Fuel Report Expanded Summary
  - World Nuclear Performance Report 2020

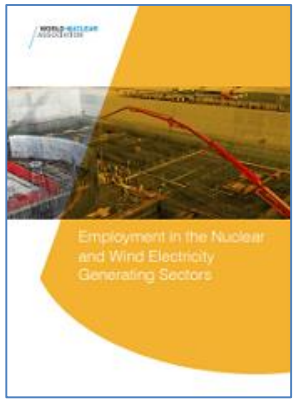


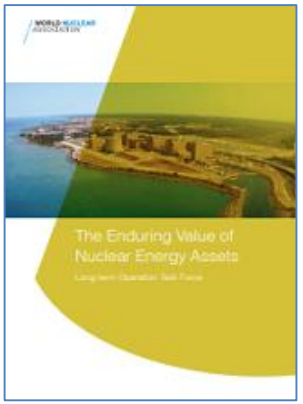
WNA New publications

- **White paper:**
  - Building a stronger tomorrow: Nuclear power in the post-pandemic world

- **Policy paper:**
  - Policy Paper

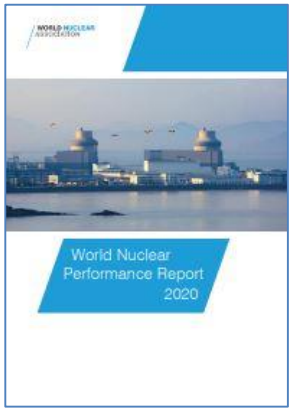
- **Technical position papers:**
  - Employment in the Nuclear and Wind Electricity Generating Sectors
  - The Enduring Value of Nuclear Energy Assets



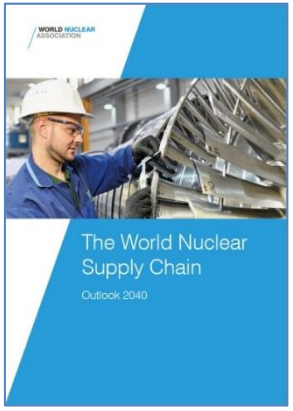


WNA New publications

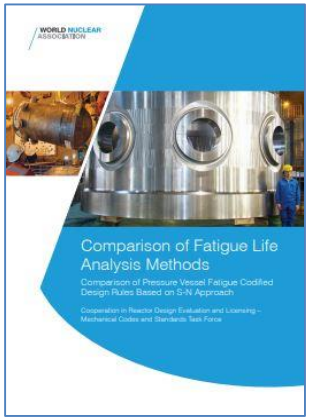
- [World Nuclear Performance Report 2020]



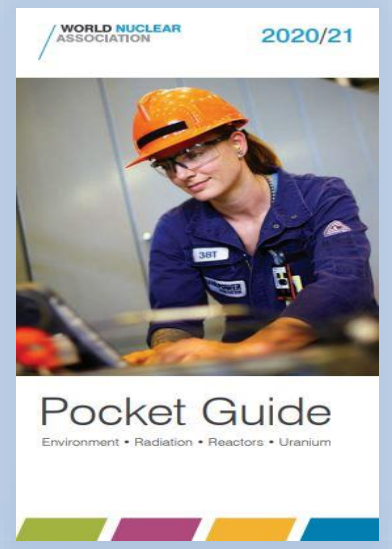
- [The World Nuclear Supply Chain: Outlook 2040]



- [Comparison of Fatigue Life Analysis Methods]



- [Pocket Guide 2020/2021]



WNA also expresses the voice of Nuclear Industry in the Press

→ 14 press statements so far in 2020

Including :

- Commenting on IEA data on Global CO2 emissions in 2019, February 2020
- Welcoming the first unit of the Barakah nuclear power plant receiving its operating license, February 2020.
- Reacting to the IEA Global Energy Review 2020, April 2020
- Highlighting the contribution of new nuclear in the post-pandemic recovery (J-B Levy speech at the IEA ministerial roundtable), May 2020
- Responding to the IEA's WEO Special Report on Sustainable Recovery, June 2020
- Promoting the OECD-NEA policy briefs highlighting nuclear power as a key pillar of post-pandemic recovery, June 2020
- Launching World Nuclear Performance Report and Supply Chain Report, Sept 2020
- Welcoming grid connection Belarus unit 1, Nov 2020

WNA organises and fosters Important events

World Nuclear Association Strategic eForum 2020

High-level panels:

- Building a stronger and cleaner tomorrow with nuclear energy
  578 participants from 60 countries (9-11/09/2020)

- Driving investment towards nuclear projects
  435 participants from 49 countries

- Maximising nuclear energy's socio-economic & environmental benefits
  339 participants from 41 countries

- Launching The World Nuclear Supply Chain: Outlook 2040 Report
  23 September

- Working Group meetings
  1-25 September

Bimonthly newsletter - Harmony Goal Tracker

WORLD NUCLEAR ASSOCIATION

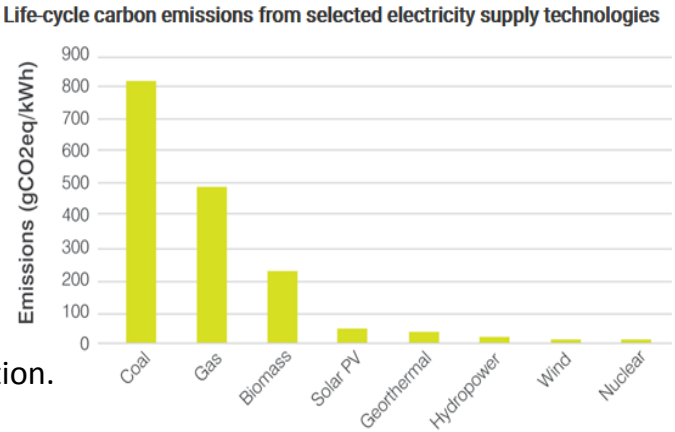
HARMONY
What will power our electric future?

To meet the growing demand for sustainable energy, we will **need nuclear to provide 25% of electricity before 2050 as part of a clean and reliable low-carbon mix**.

Achieving this means **nuclear** generation **must triple globally by 2050.**
The Harmony programme is a global initiative of the nuclear industry that provides a framework for action, working with key stakeholders so that barriers to growth can be removed.

Why we need Harmony

An increased share of low-carbon sources, as well as a drastically reduced level of fossil fuels, work together in harmony to secure a reliable, affordable and clean future energy supply 24 hours a day.
Access to electricity and **clean air** are vital needs.
Currently **one out of six people** in the world has **no** access to **electricity**.
As electricity demand continues to rise, **greenhouse gas emissions must fall to mitigate climate change** and we must switch to cleaner sources to reduce air pollution.



Source: 2014 IPCC, Global warming potential of selected electricity sources

This will require **large increases of all low-carbon energy sources**, of **which nuclear is an important part**.

Nuclear power is one of the most cost-effective low-carbon options for generating electricity.

Nuclear: an important part of the energy mix

The international community recognizes the urgent need to decarbonize our electricity generation to protect people and the planet from the dangers of air pollution and climate change. Nuclear energy is proven, available today and can be expanded quickly, making it an important part of the solution. According to the OECD Nuclear Energy Agency "a mix relying primarily on nuclear is the most cost-effective option to achieve the decarbonization target of 50 gCO_2 per kWh."

Events

✓ **1-25 September 2020** – Working Group meetings, Online

✓ **2 September 2020** – Strategic eForum pre-event on *Industry Gamechangers*, Online

✓ **9-11 September 2020** – World Nuclear Association Strategic eForum 2020, Online

✓ **23 September 2020** - Launching The World Nuclear Supply Chain: Outlook 2040 Report, Online

- **12-13 January 2021** – Working Group meetings, Online
- **12-13 April 2021** – Working Group meetings, Stockholm, Sweden
- **13-15 April 2021**– World Nuclear Fuel Cycle 2021, Stockholm, Sweden
- **8-10 September 2021** – World Nuclear Association Symposium 2021, London, UK

Thank you for your Attention

www.world-nuclear.org

EU-H2020- SHARE-Decommissioning
FORATOM on RWM and Decommissioning activities

Berta Picamal
DG Office, Legal and International Relations Director

1.12.2020

Sustainable Finance Initiatives – Taxonomy

Financing Sustainable Growth

The EC adopts an Action Plan on Financing Sustainable Growth in March 2018

With a regulation on the establishment of a framework to facilitate sustainable investment

Establishes a series of Technical Experts Group (TEG) of which:

- Nuclear
- Do No Significant Harm

Nowadays situation

Confirms that nuclear is low-carbon and therefore contributes to **climate mitigation**

- BUT (on the DNSH criteria)
  - TEG believes that there are significant data gaps
  - TEG finds that existing evidence is complex and difficult to evaluate
  - TEG notes that nowhere in the world has a viable, safe and long-term underground repository been established

Conclusion: nuclear not in, nor out

LETS BE CLEAR: it is not a technical problem, it is a political one…
JRC to establish report on radioactive waste management – expected early next year?

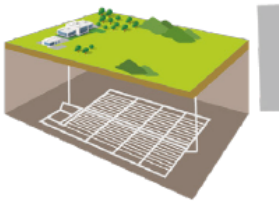
1st Delegated Act (Mitigation): published 10 days ago, and still nuclear not contemplated…

Why develop such a tool

Sustainable Finance Taxonomy:

- Discussion shows that many stakeholders are not aware of:
  - What nuclear waste is
  - How much is generated
  - The solutions which exist to handle such waste
- Our current narrative is not resonating with EU audiences
  - At EU level, stakeholders understand the notion of the circular economy and waste hierarchy
  - and our narrative needs to fit into this understanding
- Many communication channels exist today
  - We established the narrative
  - and then developed a series of tools to meet all requirements

APPLYING A CIRCULAR ECONOMY APPROACH TO RADIOACTIVE WASTE



REDUCE
Reduction in the volumes of waste generated thanks to:
- Improved reactor design
- Improved reactor operation
- Improved fuel production

REUSE
Several technologies exist which enable the reuse of spent fuel

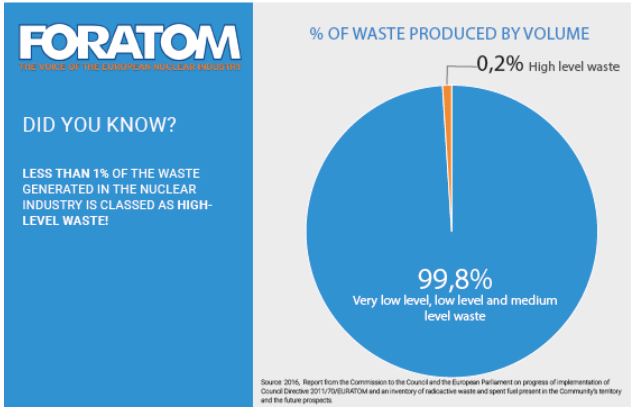
RECYCLE
Construction materials used in nuclear facilities can be fully recycled.
Americium and plutonium can be recycled in space, medical and other applications

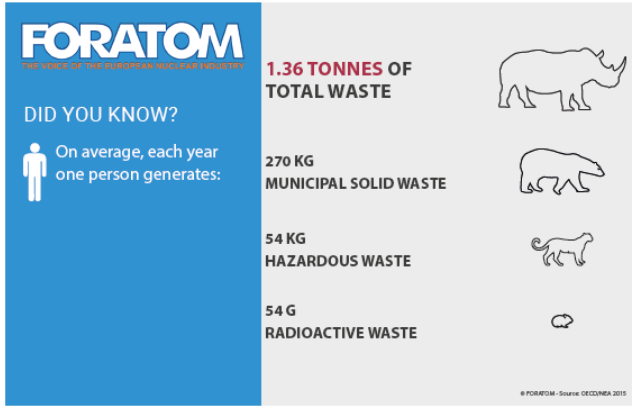
RESIDUAL
Temporary storage: Some countries use temporary storage in order to enable the future retrieval and reprocessing of the spent fuel

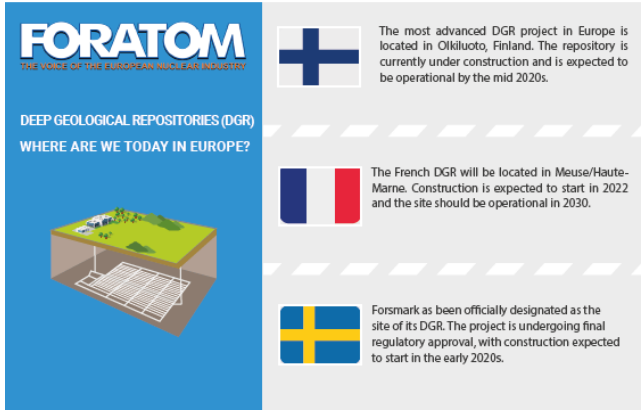
RESIDUAL
Long-term disposal: The nuclear sector is a leading example when it comes to the long-term disposal of radioactive waste thanks to, for example, the Deep Geological Repositories currently under development.

CIRCULAR ECONOMY IN THE NUCLEAR INDUSTRY

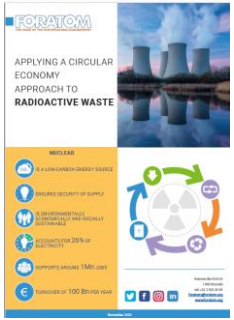
Use on social media

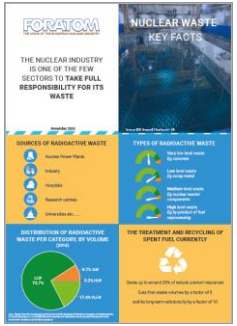


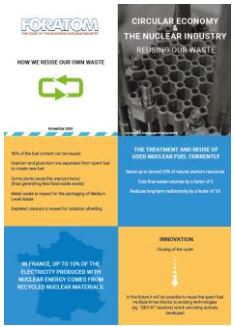




Document types







Developed so far:

- Booklet
- Did you knows
- Individual fiches

Additional tools:

- Animations
- Videos
- Dedicated website section

Outreach

- Roll out via FORATOM communication channels
- Members have expressed a willingness to adapt them for national use (translation + national key facts)
  - FORATOM will also use the national adaptations with MEPs (good to match the tool with the nationality of the MEP)
- Dedicated website section + case studies:
  - Enable countries and companies to disseminate national/company specificities
  - Will include a library of more scientific reports and studies for audiences who are interested in receiving more information (“Onion” approach)

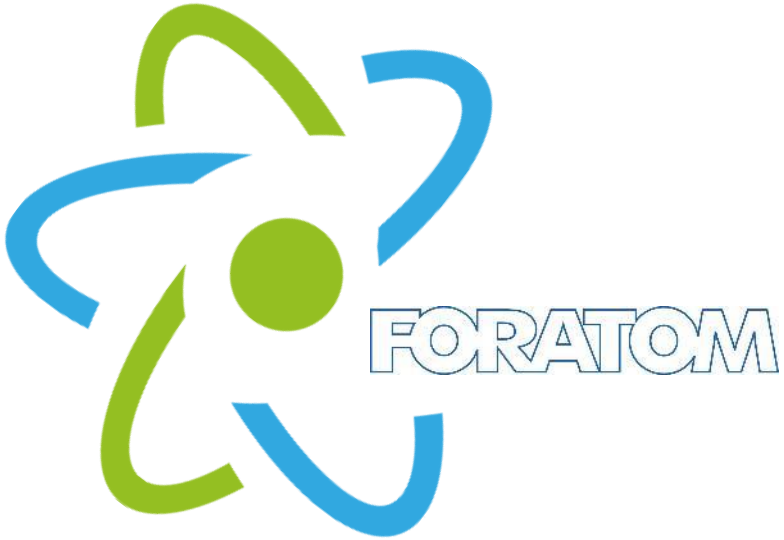
FORATOM WG activities

Background (technical) papers to support communication tools:

- Radioactive waste and spent fuel management (categories, volumes, toxicity, techniques for storage and disposal, comparison with other industries waste management policies)
- Deep Geological Repositories: most sensible from a political and social/societal point of view (comment in final report of TEG on Taxonomy…) : focus on a variety of issues from stakeholders' engagement and illustrative examples of progress to economics
- Decommissioning of NPPs: partner in H2020 RIMA Project which includes funding to support the use of robotics and digital techniques which are we consider key R&D areas for decommissioning activities e.g in dismantling and segregation.

- Position Paper on Clearance levels

Thank you



Overview of EPRI Decommissioning R&D Roadmap

Richard Reid, PhD
Technical Executive

SHARE Workshop
01 December 2020

Issue Statement

Decommissioning must be viewed as an industry issue

Costs must be well managed to support industry viability

Actual costs affect required decommissioning funding set-asides for operating plants

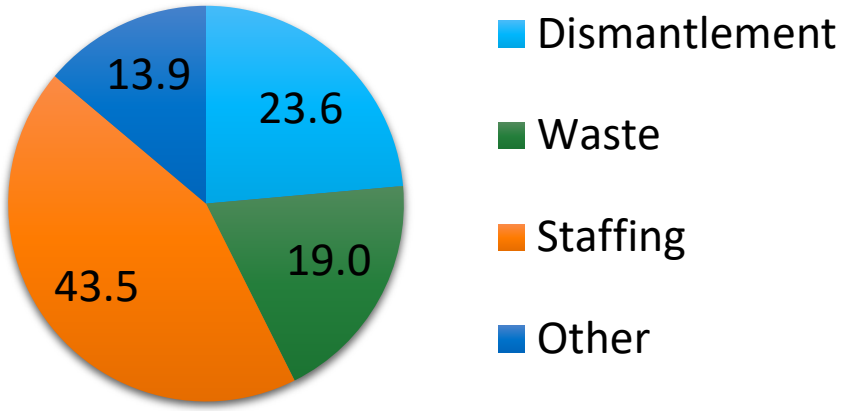
Utilities, Regulators, Service Providers and Research Organizations all have a roll in safe and efficient decomissioning

Decommissioning is part of the overall life cycle cost for a plant

Decommissioning Research and Development Drivers

- Technologies exist for successful decommissioning
- Overall cost driven by period dependent costs ("hotel load")
- Technology improvements needed to shorten duration
  - Cost of staffing during decommissioning: $25M per year or more
  - Other period dependent costs: $2M per year or more

Cost Categories as Percentage of Total Costs



EPRI Report: Decommissioning Experiences and Lessons Learned: Decommissioning Costs (#1023025, 2011)

Expeditious Completion is Key to Cost Control

Changing Landscape in Decommissioning

New Business Models

- License stewardship
- Asset transfer
- Utility/Vendor Partnership
- Utilities as service providers

Increased R&D Spending

- Service providers
- Global R&D organizations
- Global governmental organizations

Global Challenges

- Lack of waste disposal
- Lack of regulatory structure
- Lack of experienced service providers
- Lack of human resources

We must ensure alignment and ability to respond to changing needs

What Can We Do?

Utilities

Planning
Record keeping
Regulatory engagement

R&D Organizations

Guidance
Technology
OpEx and Lessons Learned
Global collaboration

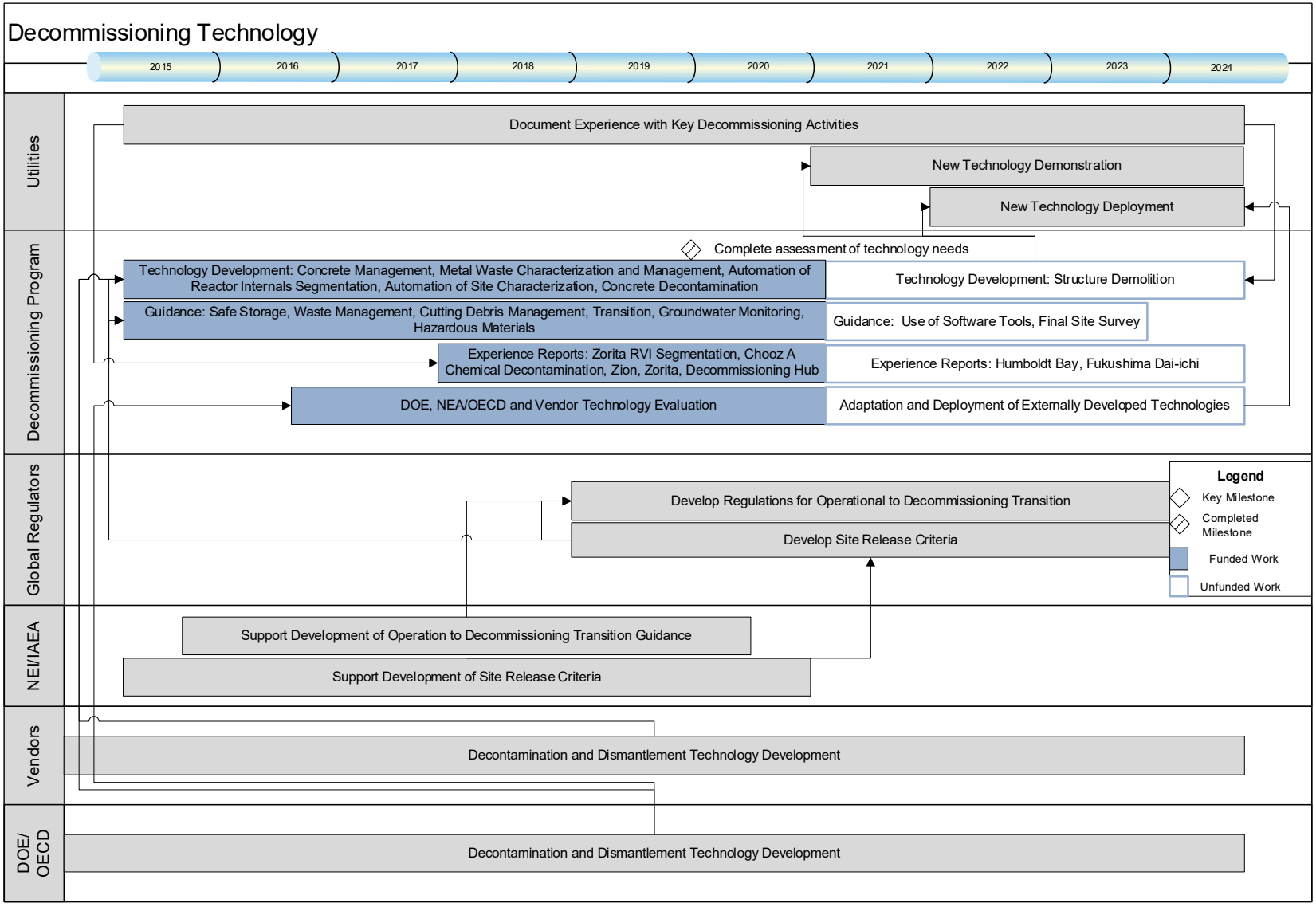
Service Providers

Technology implementation
Qualified and experienced resources

Regulators

Guidance and regulations for all phases
Workable waste management requirements

EPRI Decommissioning Technology Roadmap



2020-2021 R&D Projects

Planning/ Regulatory	Dismantlement	Waste Management	Site Characterization and Release
• Enhancements to Decommissioning Hub website •Evaluation of the use of building information models for decommissioning planning •Evaluation of the use of augmented intelligence in decommissioning planning •Decommissioning Training Development	• External collaboration on decommissioning R&D (DOE, NEA, IAEA, and others through SHARE) •Automation of reactor vessel and internals segmentation •Enhanced techniques for concrete decontamination	• Characterization of long-lived, hard-to-measure activation products in irradiated metals •Best practices for decontamination, recycling and reuse of contaminated metal and concrete waste	• Automation of site characterization •Software for management of data from Final Status Surveys

Future R&D Projects

Planning

- Guidance on Cost Estimation
- Management of Risk during Decommissioning

Dismantlement

- Alpha Management for Plants with Failed Fuel
- Enhanced Technologies for Demolition of Large Structures

Waste Management

- Evaluation of State-of-the-Art Spectroscopy Systems for Waste Package Characterization

Site Characterization and Release

- Enhanced Techniques for Gamma Monitoring
- Final Status Survey Guidance Update

Guided by OpEx and Utility Input

Together...Shaping the Future of Electricity

CANDU Owners Group Inc.

"Excellence Through Collaboration"

Excellence through Collaboration

CANDU Owners Group (COG) Strategic Research and Development Decommissioning and Long Term Waste Management Program Roadmap

Paul Dinner and John Krasznai (COG)

Overview Presentation for SHARE Online Meeting

Dec 1-3 2020

COG ORGANIZATION

- The CANDU Owners Group Inc. (COG) is a not-for-profit affiliation of Global CANDU Nuclear Power Plant Operators and the R&D branch (CNL) of original CANDU designer, AECL.
- COG provides a framework for co-operation, mutual assistance and exchange of information for the successful support, development, operation, maintenance and economics of CANDU technology.
- COG is a member of EPRI and manages the EPRI relationship on behalf of the CANDU utilities that are R&D funding members.

Énergie NB Power

Korea Hydro and Nuclear Power Co. Ltd. (KHNP)

Canadian Nuclear Laboratories

Hydro Québec

中国核电 CNNP

中核核电运行管理有限公司

NUCLEOELECTRICA ARGENTINA S.A.

NUCLEARELECTRICA

Bruce Power

ONTARIO POWER GENERATION

Nuclear Power Corporation of India Limited

COG

COG R&D Program

- **Base Program**
  - Applied R&D – Relatively short horizon – 3 years
  - Focus on regulatory issues and incremental operations & maintenance improvements
    - Fuel Channels
    - Chemistry Materials and Components
    - Health Safety and Environment
    - Safety and Licensing
    - Industry Standard Tool set
- **Strategic Program**
  - Long Term vision – long term horizon - >10years
  - Development of transformative technologies

STRATEGIC R&D FOCUS AREAS

Strategic Focus Areas Under Development

- **Outage Reduction**
- **Enhanced Computer Codes to Improve Safety Margins**
- **Improved Materials to extend reactor life.**
- ***Technology and infrastructure to support decommissioning and long term waste management***
- **Assess potential impacts of climate change on CANDU operations and facilities.**
- **Develop technology to reduce environment impacts from normal operation.**
- **Advance knowledge and public acceptance of low level radiation.**
- **Human performance and organizational aspects of nuclear generation.**

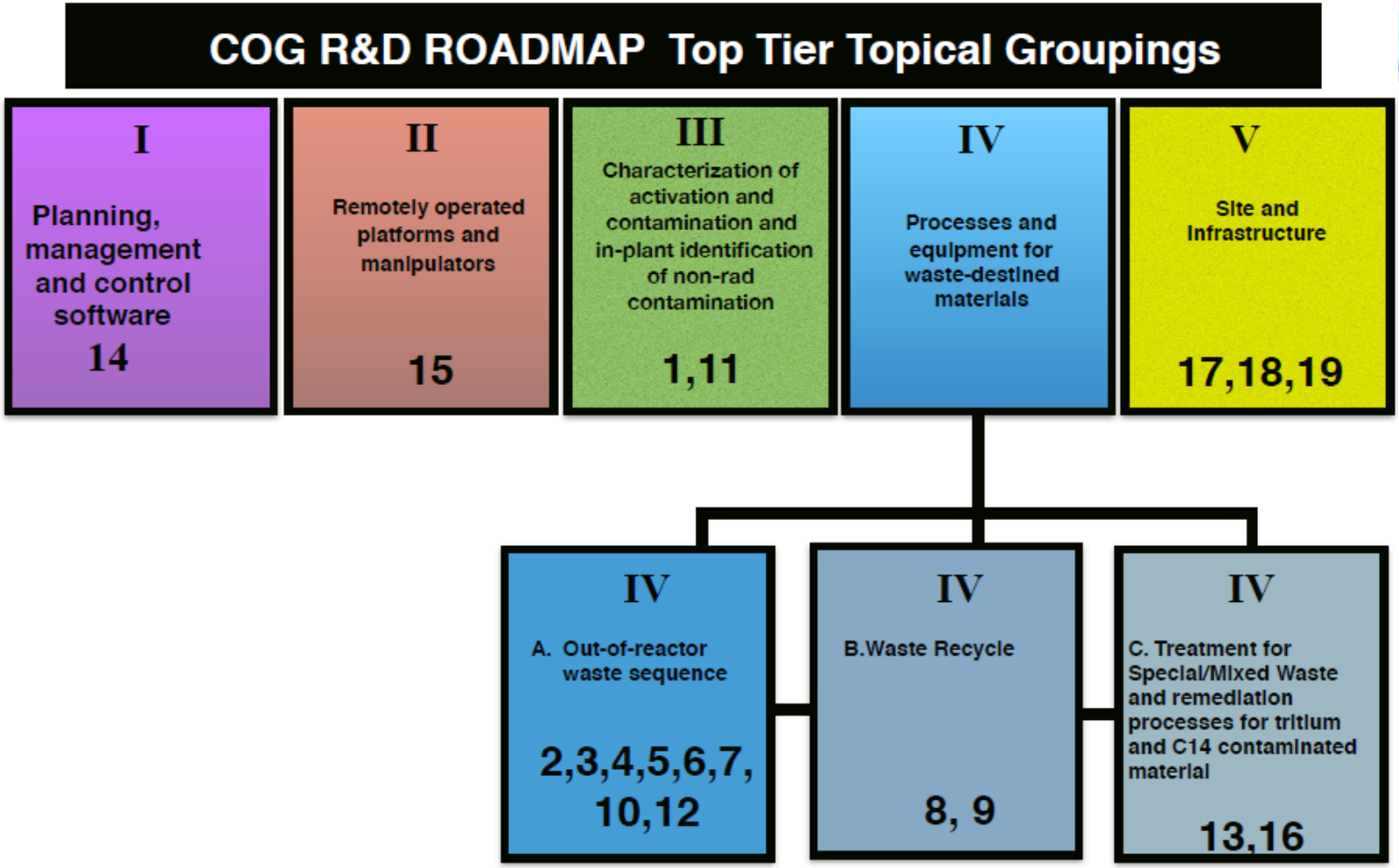
DLTWM Program Goals
Based on input from Senior Nuclear Executives

:

1. Progressively reduce L&ILW waste costs and volumes by 50% over 25y through reduced waste generation and improved processing

2. Provide "faster, better and cheaper" low-dose decommissioning technologies and strategies relative to current practices

High-level DLTWM Roadmap Structure



DLTWM Issued Work Packages-1

73001	Provide Roadmap(s) to develop technology and infrastructure to support decommissioning and long term waste management
73002	COG SRD Decommissioning and Long-Term Waste Management Roadmap Support
73004	Support for COG SRD Decommissioning and Long-Term Waste Management Roadmap Development
73005	Membership in EPRI Supplemental Program on Remediation and Decommissioning
73006	Improved L&ILW processing, packaging and storage
73007	Strategies for Improved Management of C-14 Contaminated Wastes in CANDU Reactors
73008	Methods for Analyzing Toxic (non-radiological contaminants) in Mixed Wastes in Selected Components and Building Materials

DLTWM Issued Work Packages-2

73009	Strategies for Tritiated Water Management - Detritiation and Alternatives to Detritiation for both H2O and D2O
73010	Integrate Technologies needed, as a package to simulate CANDU decommissioning
73011	Robotics and Automated Systems Application to CANDU Decommissioning Activities
73012	Compare and Verify Calculated Radionuclide Inventories and Distributions with Materials Characterization Data to Improve the Accuracy of CANDU Decommissioning Waste Estimates
73013	Technologies for Radiological Characterization of CANDU Components
73014	Assessment of Strippable Coatings for Effective Removal of Loose Contamination from the Surfaces of CANDU Components
73015	Monitoring and Modelling of Environmental Contaminants in Soil and Water
73016	Technologies for Decontamination of CANDU Concrete Structures (finding a site to do proof of concept with EPRI)
73017	CANDU 600 Materials (Waste) inventory and cost data

Examples of Additional DLTWM Activities Under Consideration

Benchmarking of Stakeholder Engagement Plans and Processes for Decommissioning
Modelling of activation of in-vault components of a CANDU-6
Non-fuel materials activation for CANDUs from material impurities
Development of a generic CANDU 600 reference case
Heavy Water Management at Decommissioning
Intermediate Waste Liability at Decommissioning: P1-P4 Dry Storage Modules
IoT and AI Application to CANDU Decommissioning

Examples of Results from Roadmap Implementation to-date

- Cost-effective opportunities for use of robotics in CANDU decommissioning identified and prioritized
- Typical CANDU-600 Waste Quantities from decommissioning identified by composition & category
- ILW Quantities, characteristics & locations documented
- OPEX and promising avenues for decommissioning simulation identified
- Review of field monitoring requirements and available technologies for decommissioning carried out.
- Experience with strippable coatings for decontamination compiled and test program underway for select options
- Initial geostatistical evaluation (optimization) done for soil/water sampling requirements of CANDU sites

SUMMARY

- COG has conducted a high level review of the Decommissioning technologies landscape being developed and utilized around the world.
- Considering
  - (1)the unique aspects that differentiate CANDU vs LWRs,
  - (2) the state of the art and
  - (3) lessons learned from ongoing R&D and projects,
- COG has created a program plan that will bring better solutions and efficiencies to Decommissioning and Long term waste management.
- Since its Launch in 2016, approximately 20 Work Packages have been Initiated and requirements defined for an additonal 20

Initiation to break-out sessions with MURAL Tool

https://share-h2020.eu/
linkedin.share-h2020-project
linkedin/group SHARE Road map for Decommissioning

Samantha Ree, NNL and Romain Tricon Duez, In Extenso

1-3 December 2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement nº 847626.

For the break-out sessions, we will be using MURAL

Modifiez le style du titre

Interactive tool for brainstorming together

Technical requirements to run MURAL

Modifiez le style du titre

- MURAL works best with **Chrome**
- Also supported on:
  - Edge
  - Firefox
  - Safari

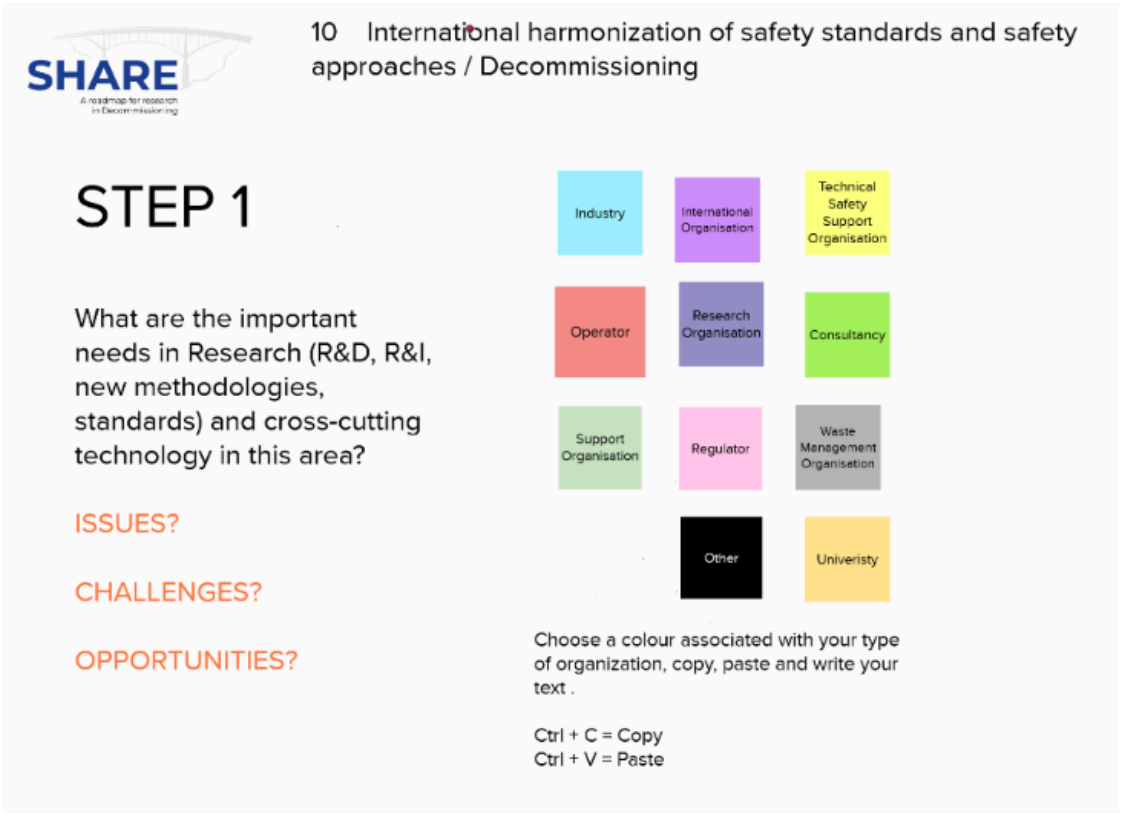
What are the activities in MURAL?

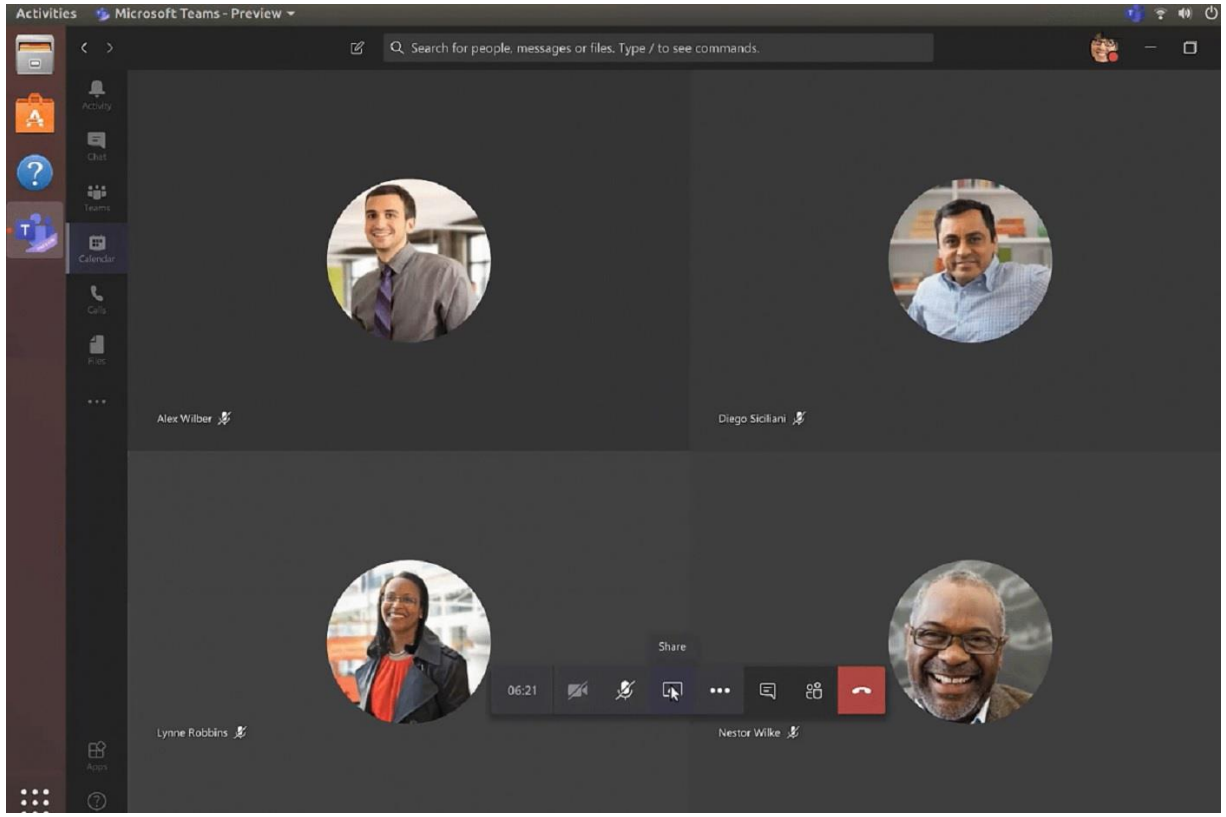
Modifiez le style du titre

STEP 1	What are the important **NEEDS** in Research* in this area?	ISSUES? CHALLENGES? OPPORTUNITIES?	
STEP 2	The facilitator will group step 1's issues, challenges and opportunities by **NEED**.	Extraction NEEDS Discussion on NEEDS Agreement	 
STEP 3	What are the **SOLUTIONS** and **OPPORTUNITIES** to meet this NEED?	Implemented Under Development Not Developed	Is there a GAP? Why is there a GAP? 
STEP 4 (Optional) Depending on time	What are the **ACTIONS** (technical and non technical) that can fill this gap?	ACTIONS	 

What do you do during a MURAL session?

Modifiez le style du titre





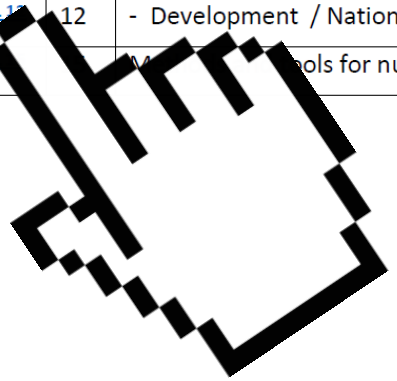
On MURAL, YOU will put post-its to give YOUR point of view

On Teams, YOU will speak to give more details and react on participants inputs

How do I join a MURAL session?

Modifiez le style du titre

GROUP A		
① Safety and Radiological Protection		
Dec. 1st	9:00 CET- 13:40: Plenary session (see general program) and switch to breakout sessions	
Dec. 1st	International initiatives	
	13:50	1A	Presentation of ETSON by Karine Herviou, IRSN (*10 min*)
	14:00	1B	Presentation of NEA Regulator forum, and /or presentation of NEA / CRPPH by Thierry Schneider , CEPN Association (*10 min*)
	14:10	1C	Presentation of "SHARE" European Platform for Social Sciences and Humanities research relating to Ionizing Radiation, by Tanja Perko, SCK-CEN (*10 min*)
	14:20	1D	Presentation of first achievements from SHARE in this area + introduction to post it session, by Reika Szoke, IFE
	14:40- 16:50 - Post it session by sub-thematic area	
	Link MURAL 10	10	International harmonization of safety standards and safety approaches / Decommissioning
	Link MURAL 11	11	- Development / National regulatory guidance for Decommissioning: Preparatory activities
	Link MURAL 12	12	- Development / National regulatory guidance for Decommissioning: Dismantling
	Link MURA		ols for nuclear safety

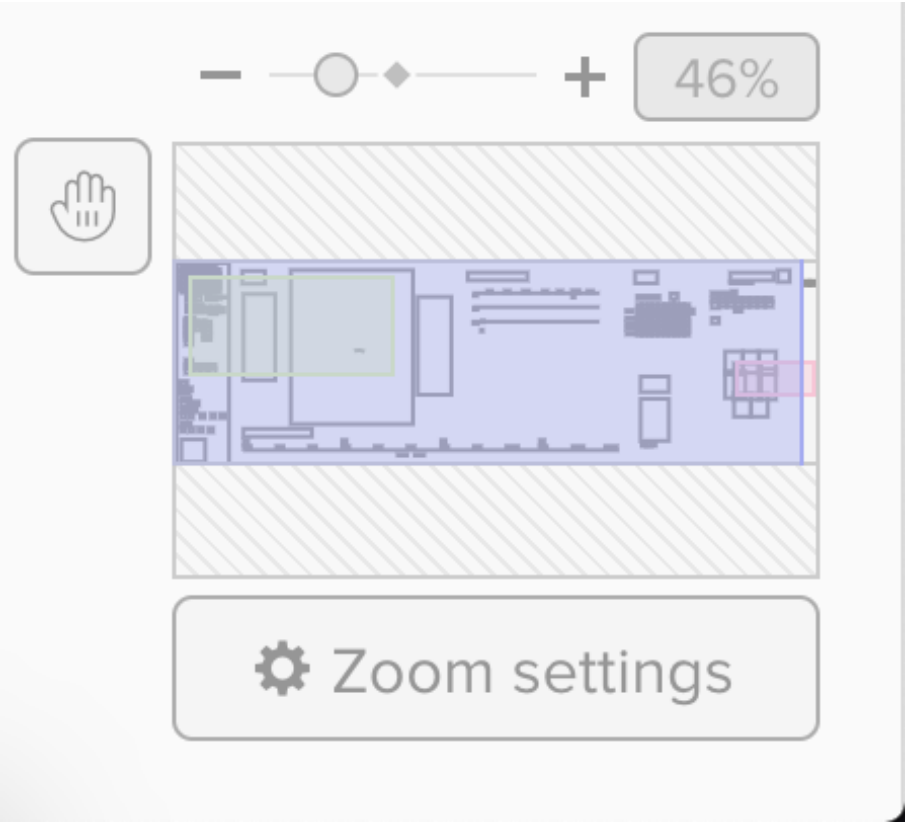


1) Go to Annex of the agenda to find the session you want to attend

2) Click on "link Mural XX" to join

How do I zoom on MURAL?

Modifiez le style du titre



To change your zoom and pan settings:

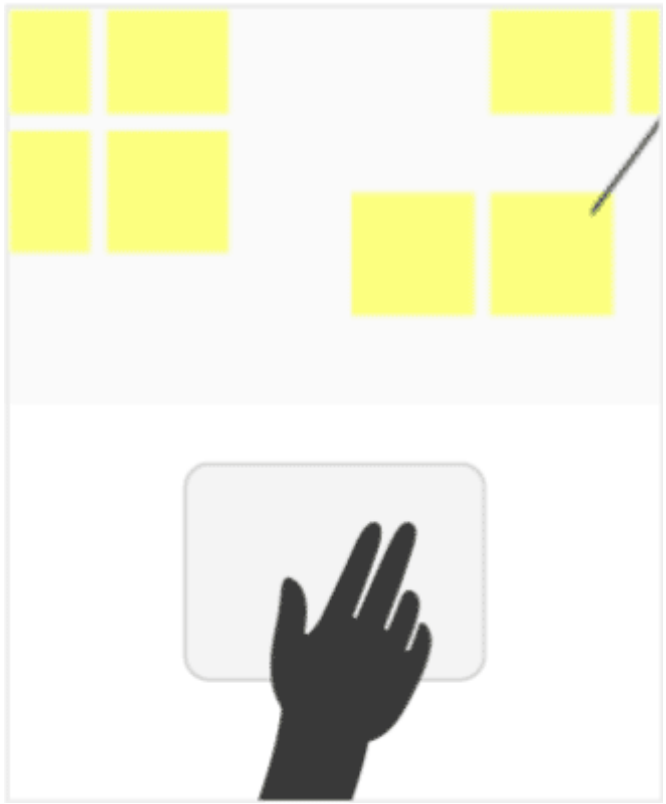
1) **Navigate to the lower right corner of your mural**

2) **Underneath the mini-map, you'll see a Navigation bar**

3) **Click "Zoom settings" to change your navigation settings**

How do I move on MURAL?

Modifiez le style du titre



SCROLLING

To scroll (move around) with the mouse click the MURAL + drag the background.

OR

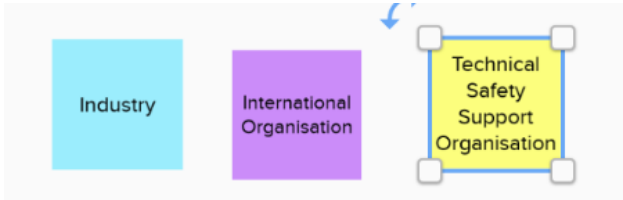
Use two fingers on the trackpad to scroll, like scrolling in a document or website.

How do I add a post-it on MURAL?

Modifiez le style du titre

1) Choose a colour associated with my type of organization

2) Copy (Ctrl+C)

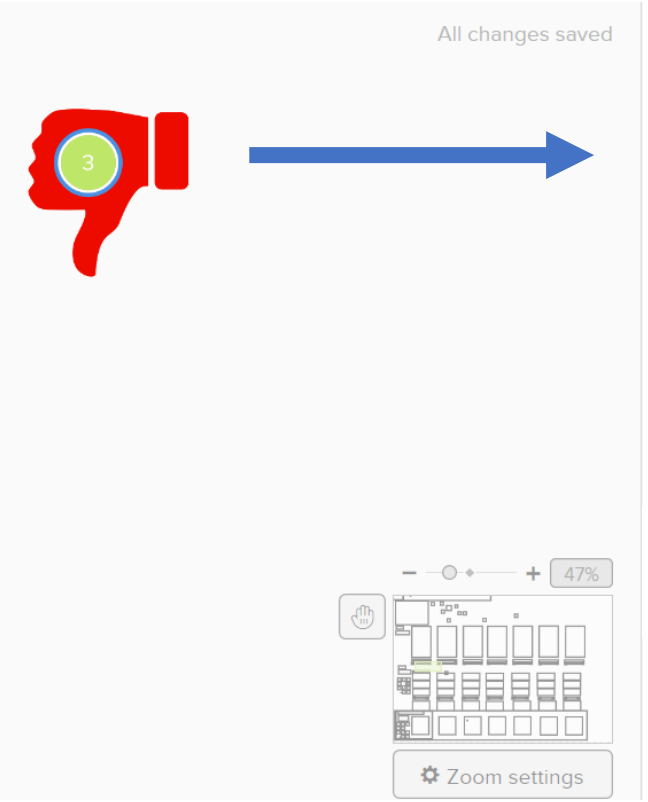


3) Paste (Ctrl+V)

4) Double click and edit text

How do I vote in MURAL?

Modifiez le style du titre



We will be using the comment feature as a voting tool.

1) Click on the number to open the comment and it will open in the comment bar.

2) See all the mural's comment threads in the comment sidebar.

3) Add your comment in the sidebar and press send.

If I can not join MURAL, what should I do?

Modifiez le style du titre

1. Let us know in the **Teams** chat. We will fix it if possible

2. If you can not join MURAL, put your comments **on teams in the chat function or discuss verbally.** The facilitators will add them to MURAL on your behalf.

MURAL Rules

Modifiez le style du titre

1. Please try to avoid editing other participant's post-it notes. Please add your own post-it to record to record your opinion.

2. To avoid confusion, we ask that people do not switch DURING the MURAL sessions.

Quick Fixes

Modifiez le style du titre

For facilitator only

If the session gets clunky the Facilitators can, 'Hide non-facilitator cursors from everyone', by hovering your cursor over your initials at the bottom of the screen and selecting the relevant option from the drop-down menu. This may help speed the session up.

A 1 second lag may be expected with groups above 40 people.

How do I join mural session as facilitator?

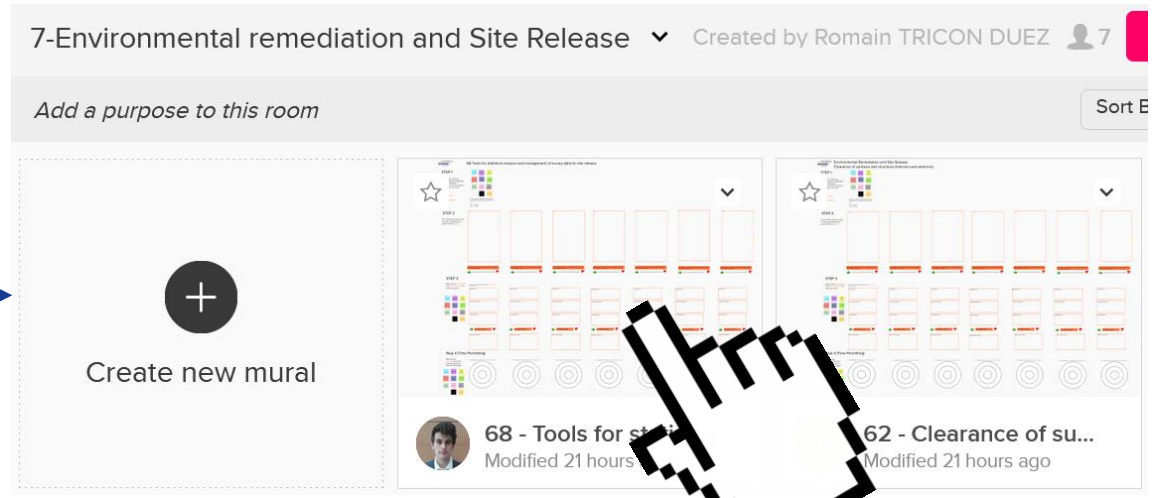
Modifiez le style du titre

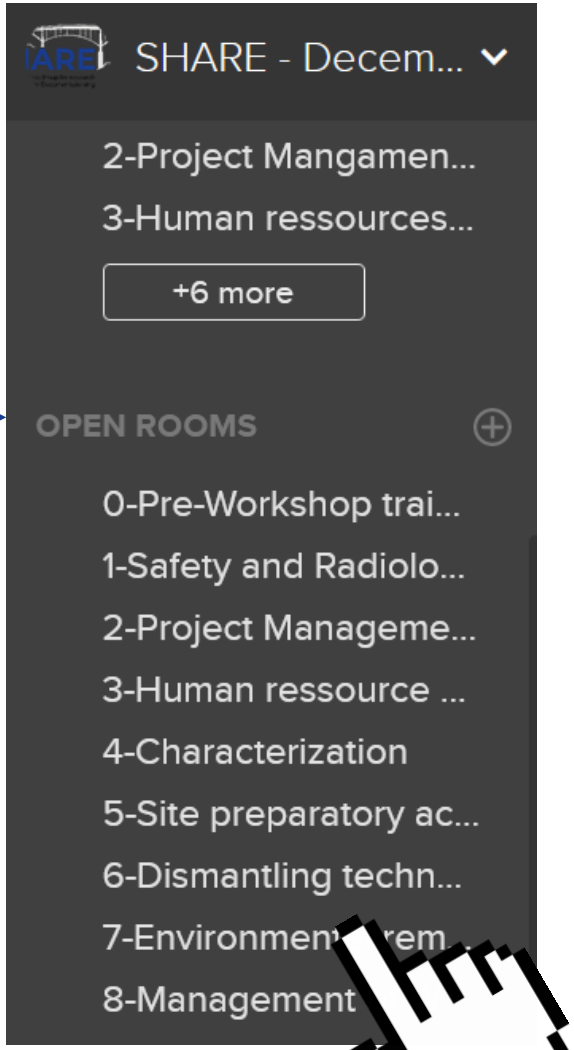
For facilitator only

1) **Login to mural**

2) **Pick the room corresponding to the session**

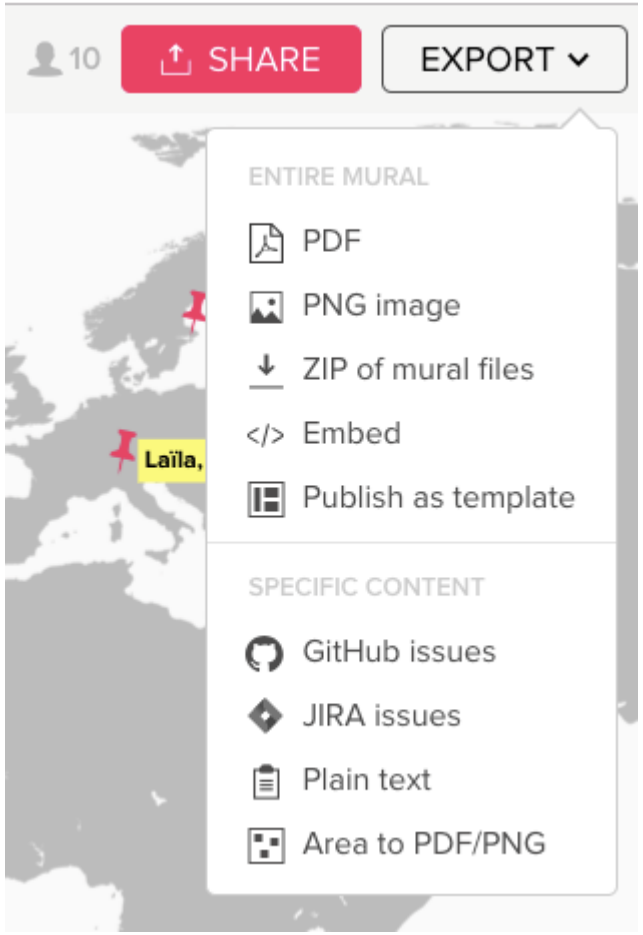
3) **Open the mural**





How do I export a MURAL?

Modifiez le style du titre



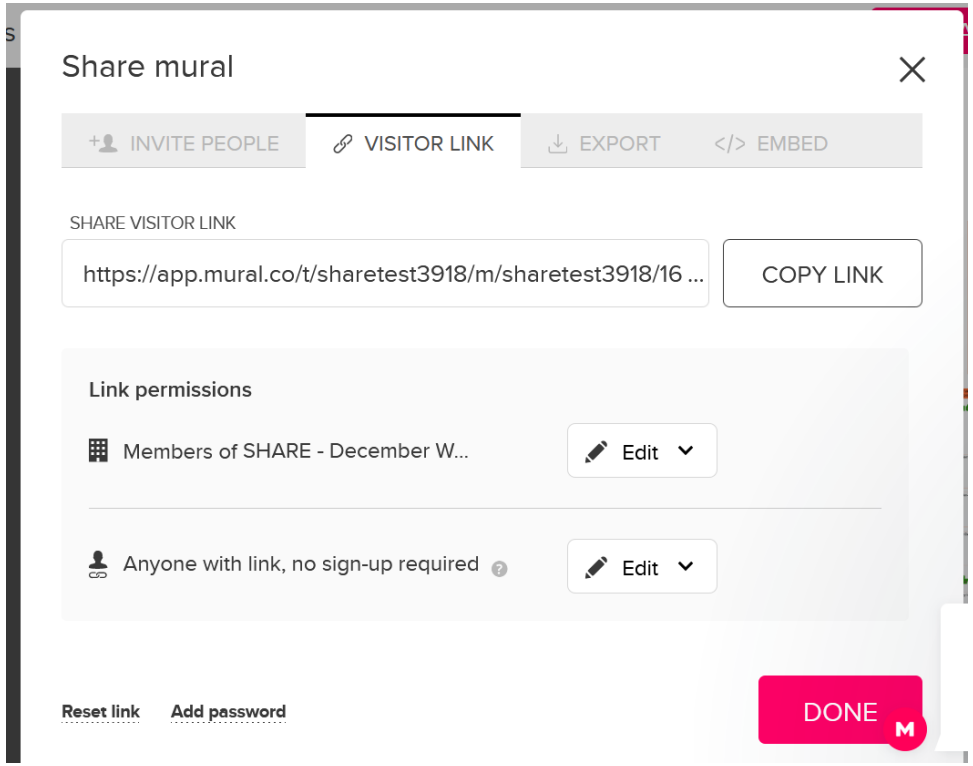
For facilitator only

1) Enter the mural you'd like to export.
2) Locate the 'Export' button on the right side of the top toolbar.
3) Click 'Export' to open the drop down menu.
4) Select whether you'd like to export as an image (.PNG) or a PDF.

How do I invite guests to a MURAL?

Modifiez le style du titre

For facilitator only



1) Enter the mural
2) Click on the pink SHARE button in the top toolbar
3) Click on ANONYMOUS LINK
4) Copy paste the link in teams