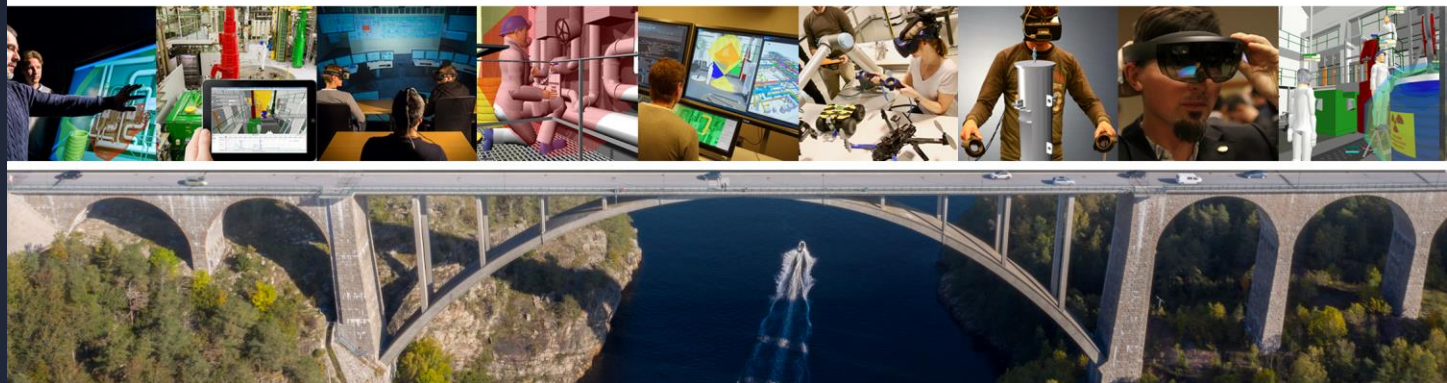




DigiDecom 2021 – DIGITAL

Online international workshop focusing on digital transformation, robotics and other game changing trends in nuclear decommissioning



DigiDecom 2021 - DIGITAL

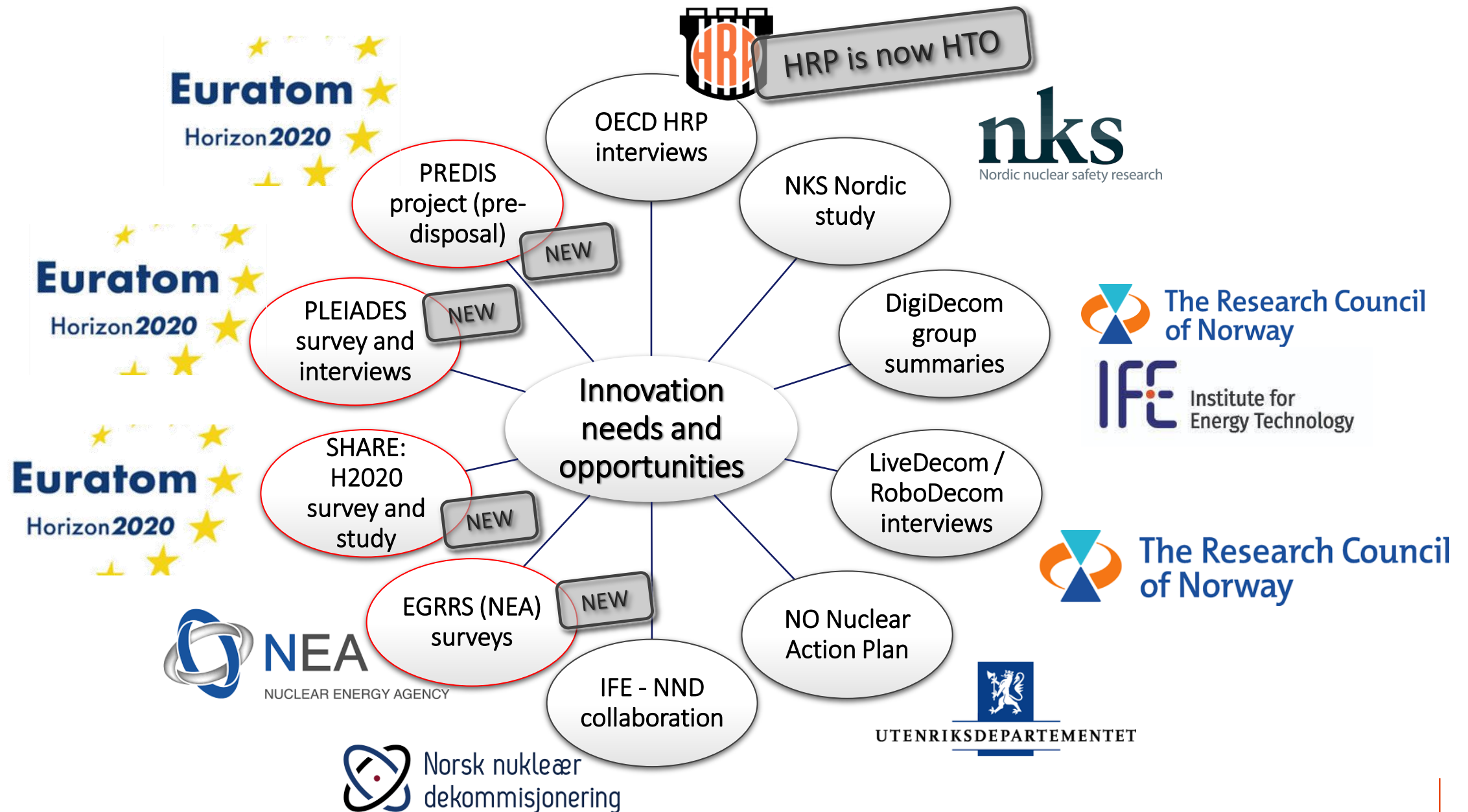
International needs and opportunities for innovation within nuclear decommissioning

Institute for Energy
Technology (IFE)

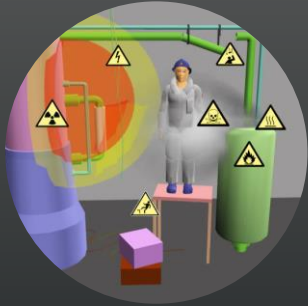
Presenter
István Szőke

Contact
Istvan.Szoke@ife.no

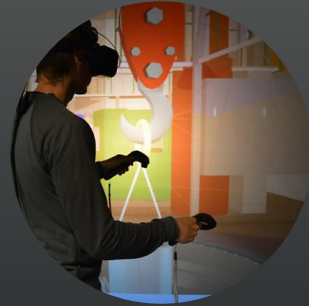
Sources for information



HRP Decom research 2018-20 > HTO Decom 2021-23



Safety management



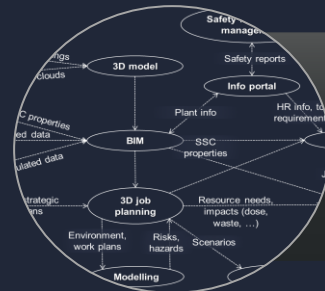
Training for normal work and emergencies



Spatial Computing and Augmented Reality for Hazard Mapping and Visualisation



Automated Assessment of Field Worker Performance using VR & AR-based Simulator Training

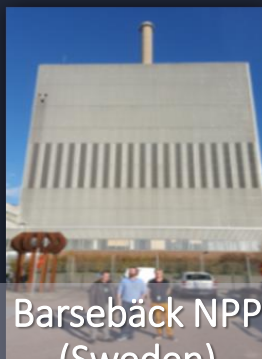


Starting: HTO Expert group for discussing other topics
Possible focus on holistic digitalisation for decom

OECD HRP Interview discussions with selected experts



Ringhals NPP (Sweden)



Barsebäck NPP
(Sweden)



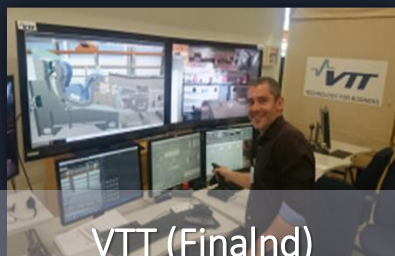
AREVA Germany



EC JRC (Italy)



SSM (Sweden)



VTT (Finland)



CEA (& NUVIA)
(France)



NNL & Sellafield (UK)



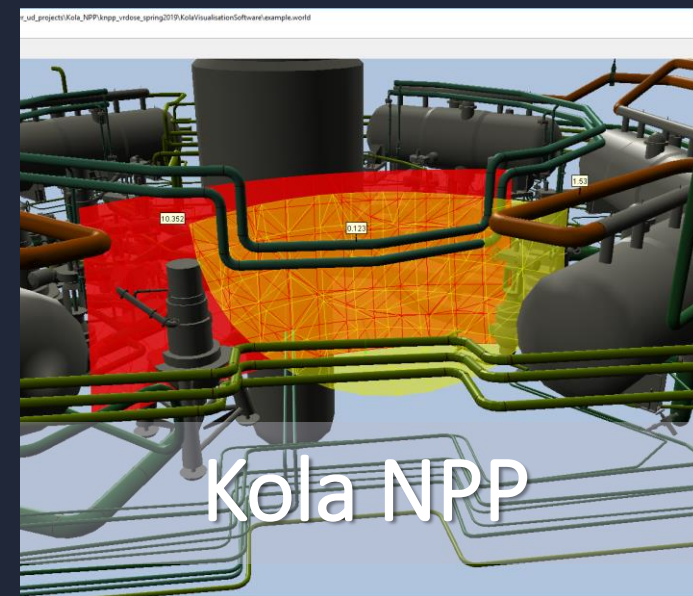
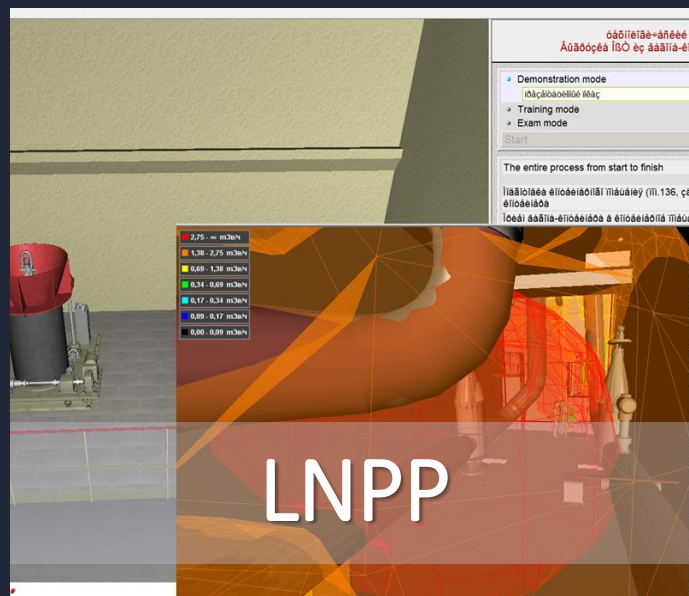
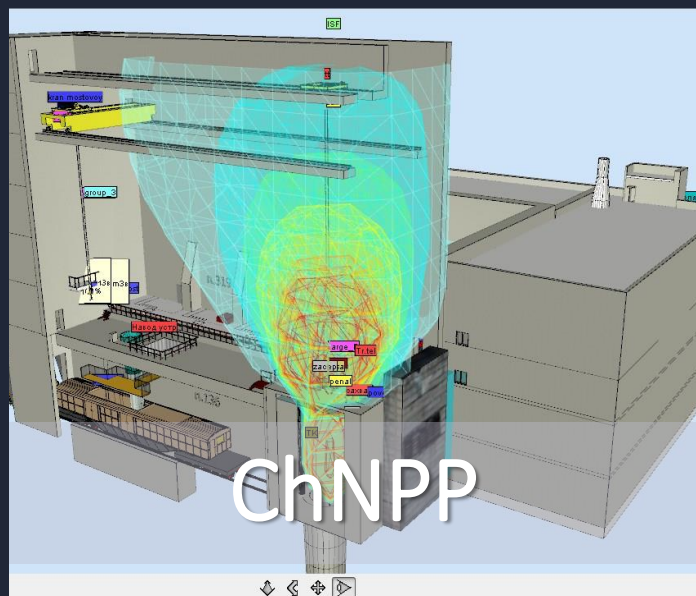
EDF (Lyon, France)



IRSN (France)

Norwegian Government's Action Plan for Nuclear Safety and Security in Russia, Ukraine and other countries in Eurasia

Several projects since 1999 and on-going

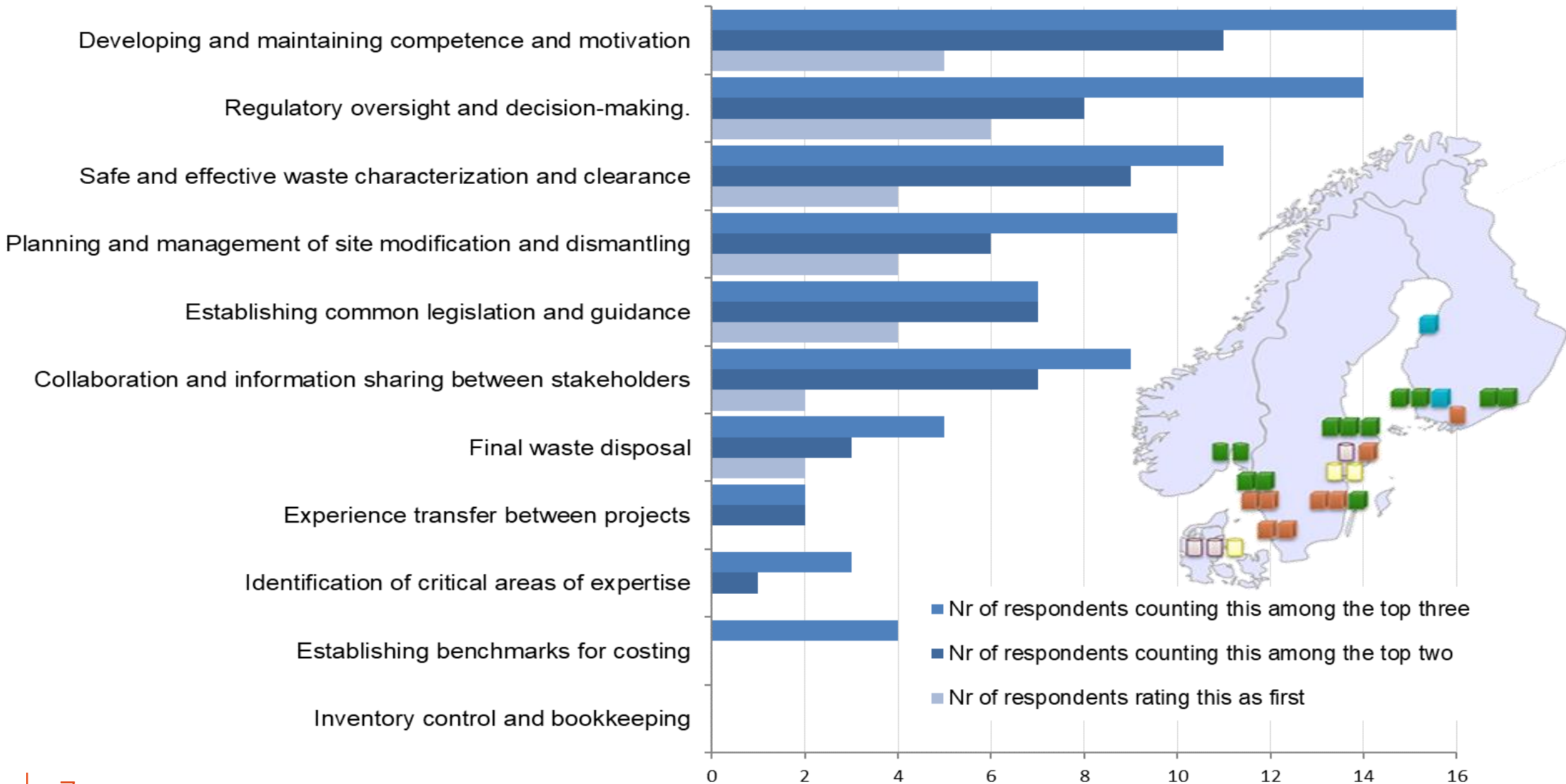


Interviews within LiveDecom & RoboDecom



		Decision	Shut down	Decommissioning license	
Life time		in Operation	in Transtion		in Decommissioning
		Decommissioning preparation	Post operation	Decommissioning preparation	Decommissioning works
		Waste retrievals			
		Decontamination/characterization			
		Decom. scenario Safety case License preparation	Defueling Decom. safety case Fuel safe storage	Contract preparation Preliminary works	
Hazard evolution		Fuel on site and legac waste removal	Fuel and legacy waste removal	No fuel but radioactive material	Radioactive material decrease
Site organization		Organization for operation	Transition from operation to decommissioning		Organization for decommissioning
		Existing operating team	Existing operating team and minor evolution	Organization evolution	Skills for project management, site management, waste management
Resources evolution		Operating staffing Decommissioning staffing			
Site ownership Waste management		Operator		Site ownership transfer Decommissioning	

The NKS NorDec Study



Organization and planning

- **Challenges**
 - Lack of decom. experience in Nordic countries
 - The scale of the decom. projects
 - Logistics planning
 - Lack of national final waste repository (delay plans and increase costs)
 - Decom. of different units at different times
- **Good practices**
 - Planning for decom. should start early

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Regulation and guidance

- **Challenges**
 - Lack of regulatory experience (decom. will be a learning experience for the regulator too)
 - Lack of regulatory guidelines (application/interpretation of regulation)
 - Need for clear and effective reporting and decision making processes (safety demonstration)
 - Regulatory framework may be especially challenging for legacy sites
- **Good practices**
 - Some decom. experience exists for research reactors
 - Recommendation on reference levels from ICRP

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Interaction between regulator and operator

- **Challenges**
 - Interpretation of regulation in practice - Need for more flexible approach?
 - Need to understand each other's roles
 - Calibrate expectations, optimise communication
 - What are contractors' role in this interaction?
 - Need for more efficient process to handle "small" issues quickly
- **Good practices**
 - Important to build and maintain a relationship based on trust
 - Active, open information exchange between regulator and operator
 - Local representative from regulator
 - Graded approach (especially for legacy projects)

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Development and maintenance of competence and motivation

- **Challenges**
 - Do existing staff have the right competence and motivation?
 - How to maintain tech. and scientific competence at the regulator?
 - Lack of nuclear education on a national level
 - Contractors may lack nuclear experience
- **Good practices**
 - Recognise as an essential part of safety and efficiency
 - Utilise competence across the Nordic countries
 - Close interaction (and workforce mobility) between regulator and operator

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Safe and effective waste characterisation and clearance

- **Challenges**
 - Compared to operation, decom. produces larger amounts, and new kinds of waste
 - More effective waste characterization methods are needed
 - Reuse (free release) can reduce costs, but challenging
- **Good practices**
 - Start planning for waste management early (early characterisation)
 - Waste acceptance criteria for future depositories?

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Decommissioning strategy

- **Preference for immediate decom.**
 - Economical and more efficient
 - Low competence and knowledge loss
 - Low chance for change in regulation
 - Don't have to do modifications later BUT not always possible/optimal!
- **Exceptions:**
 - Olkiluoto 3 will operate until 2090, all three units will be decommissioned at same time
 - Barsebäck: political decision to use deferred decom.

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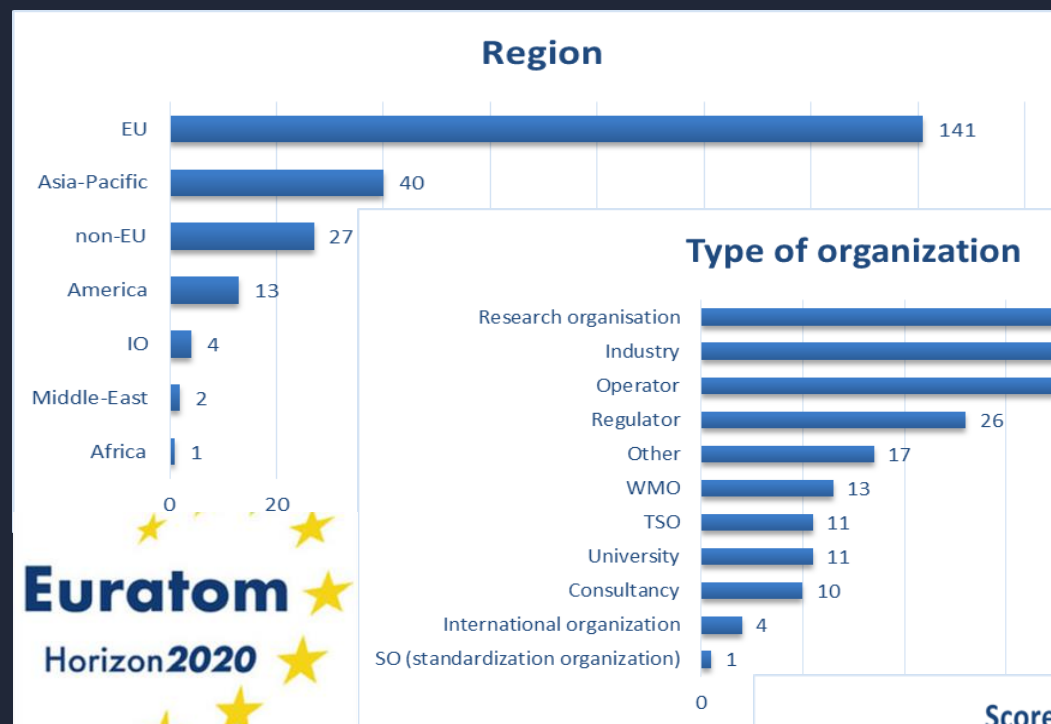
IFE

SHARE gap analysis



8. Thematic areas

1. Safety and radiological protection aspects
2. Project management and costing
3. Human resources management
4. Characterisation during decommissioning
5. Site preparatory activities
6. Dismantling
7. Environmental remediation and site release
8. Management of material and radioactive waste from decommissioning



600 + requests
200 + responses

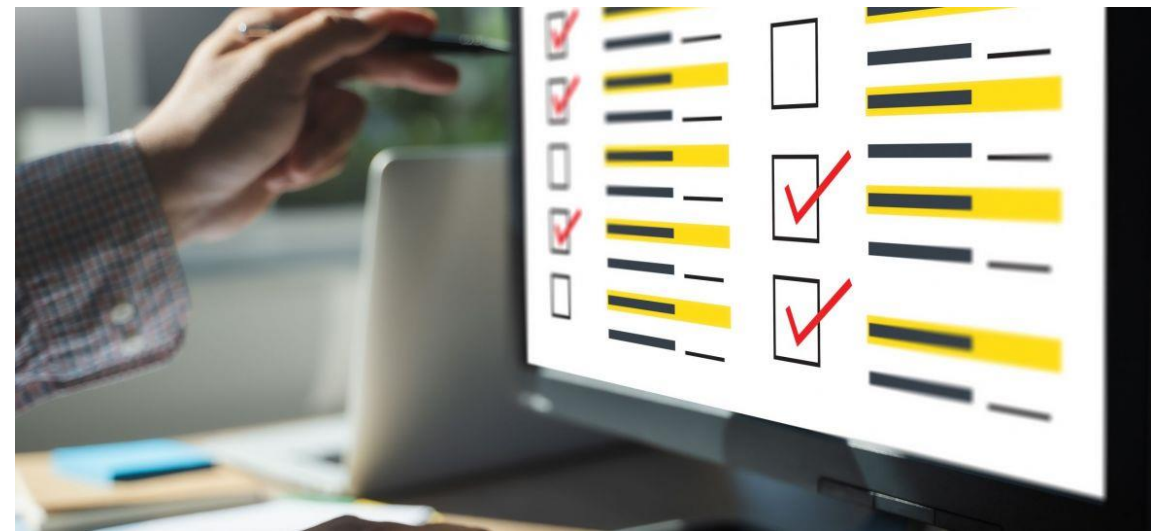
77 pre defined subtopics
rated by participants in terms of
IMPORTANCE and **URGENCY**



PLEIADES: Platform based on Emerging and Interoperable Applications for enhanced Decommissioning PRocessES

Demonstrate a **modular** software **ecosystem** based on interconnection of front-line support tools through a nuclear decommissioning specific **ontology** building upon **open BIM**.

CONTRIBUTE YOUR EXPERTISE!



<http://pleiades-platform.eu/2021/01/13/pleiades-survey/>



The Decom challenge – international landscape

Extensive workload entailing very high costs on an international level

- Low adoption of innovation
 - Joint investment in research
 - Collaborative proof of concept projects
- Foreseen shortage of skilled staff – harmonized training and education
- Knowledge base
 - Better open sharing on high and practical level
 - Standardization – international practice
- Waste management
 - Standardization – international practice
 - Global management – specially important for small organizations
- Regulation - practical application of directives
 - International collaboration, standardization
 - International guidance on innovative methods for improving capabilities

The Decom challenge – project level



- New & stronger capabilities are required for
 - Characterization, decontamination, waste management,...
 - Project management (strategic & work planning, costing, ...)
 - Agility, self-efficacy, creative thinking
 - Leadership, change management, communication, ...
- Safety management needs different approach (radiological + industrial hazards)
- Training is key
 - Shortage of skilled experts
 - Needs to be re-organized (in-house, contractors, one-off jobs)
- Knowledge management is a common area for failure
 - Knowledge loss (changing staff)
 - Right info for good decisions – old & incorrect records, unrecorded info, incompatible formats, too much info (data filtration)....
 - Information sharing across life-cycle, team members, units...

Project level - Common mistakes

Intranational experience shows that projects are sub-optimal in several perspectives

- Early and adequate planning
- Systemic approach (technology + human & organisational issues) in
 - Change management (leadership, mindset, motivation, roles, responsibilities)
 - Capability mapping and building
 - Knowledge (and information) management - traceability
 - Human resource development
 - Communication (stakeholders, public)
 - Training
 - Project management
- Planning for the future (roadmap) – ready for changes along the road (agility)

Issues for digital transformation

- Management wants cost/risk–benefit analyses
- Management may not be open-minded ('can be done without')
- Used for individual goals rather than across units, tasks, project(s), ...
- Not integrated into organizational practice
- No dedicated team at the end-user driving adoption
- Vendors trying to create super-tools (no integration with existing solutions)
- In-house solutions by the licensees – compatibility & long-term support concerns, plans for commercialisation, ...
- Tech is not field ready for everything
- High acceptance in training, BUT mainly gaming tech - needs integration with physics modelling, human performance measuring, ...

Training and information

‘Retention rates for lecture style learning were at 5% and reading rates were at 10%, while the method of VRLearn had a retention rate of 75%.’

Virtual Reality Learning report by Masie.com

‘The biggest barrier to wide adoption of immersive technologies is the lack of **good user experience design**’

© 2019 Gartner

- ❑ User acceptance
 - ❑ Effectiveness
 - ❑ Recall decay
 - ❑ Cost
 - ❑ Time
 - ❑ Portability
 - ❑ Flexibility
- Situation awareness
 - Agility (understand and react)
 - Procedural training
 - Psychomotor skills

Business case / trend (When? Who? Where?)

1. Special (safety critical) jobs where traditional methods are clearly inadequate

- Accident sites e.g. Fukushima, Chernobyl, ...
- Legacy sites with high hazards to humans
- Specific jobs at 'normal' sites

2. Fleet decommissioning where return on investment is easy to argue for

- Organisations in charge of multiple facilities/sites
- Engineering companies supporting multiple projects

3. Newcomer organisations into the field of decom/nuclear

Business case / trend (How?)

1. Mostly *specific* objectives for specific tasks (e.g. *digital training* for safety critical jobs)
2. Most prominent more general application is digitalized *facility configuration* management
3. Increasing number of examples for integration of different digital capabilities – movement from **one fits all solutions** to *modular concepts*
4. Emerging interest in integration with safety/risk analyses and robotics

Thank you for your attention



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