

# SHARE

H2020 NFRP-2018 CSA: Coordination and Support Action

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## D2.2: Title of the deliverable

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## Version history

<b>Version</b>	<b>Date</b>	<b>Editors</b>	<b>Description</b>
V1	19.12.2019	Emilio Garci Neri [ENRESA]	Writing and structuration of the deliverable
V2	20.12.2019	Pierre JOLY [EI]	Review and finalisation of the deliverable

## Abstract

This deliverable presents the consolidated questionnaire that will be submitted for comment and approval to the ERP of the project in order to build the final version that will be use in our inquiry.

## Deliverable content

### 1.1 Structuration of the questionnaire:

The questionnaire is composed of two main parts:

- A first one identifying the inquired stakeholder profile and explaining the survey objectives as well as giving instruction on how to complete the survey.
- A second one consisting in the core questionnaire

### 1.2 Questionnaire

Survey of Decommissioning Research Needs

#### STAKEHOLDER PROFILE

#### TO BE ADAPTED ACCORDING TO WP1 OUTPUT

Respondent Name: \_\_\_\_\_

Organization Name: \_\_\_\_\_

Discipline: \_\_\_\_\_ [Will include pull-down menu to include: program management, licensing, radiation protection, waste management, research, human resource management, financial management, and “other”]

Type of Organization: \_\_\_\_\_ [Will include pull-down menu to include: power reactor operator, research reactor operator, waste site operator, service provider, R&D, regulator/government organization, and “other”]

Decommissioning Experience Level: \_\_\_\_\_ [Will include pull-down menu to include none, planning, project execution on going, completed/nearly completed project(s), and not applicable]

#### **Survey Objective**

In the frame of the EU Project SHARE (Stakeholder-based Analysis of Research for Decommissioning) an inclusive roadmap for near future research will be generated with the conjoint input of the stakeholder community. This survey is a first step to establish a strategic research agenda (SRA) to define research and innovation priorities and develop an inclusive roadmap for joint near future decommissioning research for stakeholders to improve safety, reduce costs and minimize environmental impact in the decommissioning of nuclear facilities.

Various decommissioning methodologies, technologies and managements tools are at the level of maturity. However, there are still many challenges ahead. Research and innovation activities, addressing policy, economic and social issues at the same time, can play an essential role in solving them. We want to figure out where there are gaps in our knowledge and experience, and which are the terrains we need to investigate and develop in priority.

The goal of the roadmap is to organise the topics identified in the SRA (Strategic Research Agenda) in such a way that those relevant for joint activities are addressed in time according to the requirements, showing how topics should be implemented and deployed.

The identification of the most promising research and innovation topics will support EU and stakeholders in their understanding and evaluation of the strategic areas to be recommended for financial support in the next decades.

### ***Survey Instructions***

The SHARE project has identified major areas and essential topics in the field. We ask you to assess your needs for enhancement of the current situation for each topic in function of importance and urgency using a rating scale from 1 to 5 with 5 expressing the highest need.

Please add non-identified topics in the different areas and rate them similarly in function of importance and urgency with the same rating scale.

**No rating is required when you judge the topic not relevant for your needs.**

## QUESTIONNAIRE

### General overview

Decommissioning related fields for which innovation may be enhanced

1. Could you please weigh the need for innovation in decommissioning in the fields of:

– Safety and radiological protection

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY:  1  2  3  4  5  6  7  8

– Technology

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY:  1  2  3  4  5  6  7  8

– Cost management and reduction

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY:  1  2  3  4  5  6  7  8

– Stakeholders engagement

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY:  1  2  3  4  5  6  7  8

*Comments on need for innovation by fields:*

2. Which are the main drivers in your decommissioning projects?

– Safety and radiological protection

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY:  1  2  3  4  5  6  7  8

– Environmental aspects

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

– Duration

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

– Cost

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

– Materials management

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

– Technology

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

– Public acceptance

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

*Comments on Drivers for decommissioning:*

### Safety and Radiological Protection aspects

Could you please identify the needs in the following areas / topics and then rank them?

3. International harmonization of safety standards and safety approaches for D&D

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

4. Development for National regulatory guidance for D&D

a) Preparatory activities

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

b) Dismantling

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

c) Clearance of structures and materials

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

d) Final site release

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

5. Methods and tools for safety culture and quality assurance.

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

6. Methods and tools for industrial safety

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8



7. Development of radiological protection approaches and guidance for D&D

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

*Comments on Safety and Radiological Protection Topical Area:*

## Cost

Could you please identify the needs in the following areas / topics and then rank them?

### 8. Methodologies and guidance for cost estimation

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 9. Software tools for cost estimation

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 10. Development of mechanism for cost benchmarking

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

*Comments on Cost Topical Area:*

## Project Management

Could you please rate the need for innovation in relation to the following points?

11. Methodologies and software tools for comparison of alternative D&D strategies

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

12. Methodologies for risk assessment for decommissioning planning

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

13. Methodologies and software tools for project management and performance monitoring.

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

14. Tools for work data collection in the field.

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

15. Applicability and digital transformation to D&D ( 4D, big data, business inteligence).

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

16. Supply chain management for D&D.

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

17. Methods and tools for communication (public, communication)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

*Comments on Project Management Topical Area:*

## Human resources management

Could you please rate the need for innovation in relation to the following points?

### 18. Organizational model (staff and resources)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 19. Methods and software tools for knowledge management and transfer (competence preservation)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 20. General education for decommissioning

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 21. Methodologies and tools for task specific training

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

*Comments on Human resources management Topical Area:*

## Characterization

Could you please rate the need for innovation in relation to the following points?

### 22. Methodology for historical site assessment

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 23. Inventory forecast (Radiological and no-radiological)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 24. Characterization of irradiated components and areas

#### a. Metal

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

#### b. Concrete

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

#### c. Graphite

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 25. Characterization of contaminated areas

#### a) In depth contaminated concrete

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

#### b) Soils

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 26. Upgraded technologies for hard to measure areas (high walls, embedded components, harsh environment...)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

27. Development of software for simulation and modelling of irradiated components characterization.

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

28. Standards for statistical sampling

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

29. Geostatistical software applications

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

30. Sample analysis technologies

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

31. Upgraded sensing technologies for in situ characterization

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

32. Alpha and beta nondestructive measurements

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

*Comments on Characterization:*

### Site preparatory activities

Could you please rate the need for innovation in relation to the following points?

33. Adaption of auxiliary systems (ventilation, electrical, monitoring, etc.)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

34. Preparation of infrastructures and building for decommissioning (storages, capabilities for material sorting and treatment...)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

35. Systems decontamination (internal)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

36. On site Spent fuel management

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

*Comments on Site preparatory activities Topical Area:*

## Dismantlement.

Could you please rate the need for innovation in relation to the following points?

Technologies and methods related to:

37. Segmentation of large irradiated metal components (reactor vessel internals, etc.)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

38. Handling, segregation and loading of segmented elements and secondary waste

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

39. In situ Radioactive Waste characterization and segregation

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

40. Segmentation of large surface-contaminated components

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

41. Dismantling of surface-contaminated piping and small components

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

42. Segmentation of interior concrete structures (e.g., bioshield)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

43. Building surface in situ decontamination (concrete)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

44. Removal of radiological embedded elements

IMPORTANCE:  1  2  3  4  5  6  7  8



URGENCY :  1  2  3  4  5  6  7  8

45. Demolition of large, reinforced concrete structures

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

46. Robotics and remoted control tools for dismantling

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

*Comments on Dismantlement Topical Area:*

## Environmental remediation and Site Release

Could you please rate the need for innovation in relation to the following points?

47. Clearance of surfaces and structures (interiors and exteriors)

a. Methodology and procedures

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

b. Instrumentation and logistics

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

48. Characterization methods and technologies to identify subsurface contamination

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

49. Modelling and statistical tools to analyze contaminant transport in subsurface soil and groundwater

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

50. Soil remediation technologies (washing, bioremediation, fixing contamination)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

51. Remediation of contaminated groundwater (radiological)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

52. Methodologies and techniques for final release survey of the Site

a. Surface

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

b. Subsurface

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY:  1  2  3  4  5  6  7  8

53. Tools for statistical analysis and management of release survey data

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY:  1  2  3  4  5  6  7  8

*Comments on Site Release Topical Area:*

## Decommissioning material and radioactive waste management

Could you please rate the need for innovation in relation to the following points?

### 54. Management routes for materials including RW

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 55. Radioactive Waste decontamination

#### a. Physical

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

#### b. Chemical

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 56. Radioactive Waste treatment processes

#### Type of materials

#### a. Metals

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

#### b. Concrete

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

#### c. Aqueous liquids

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

#### d. Non aqueous liquids

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

e. Organic materials

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

Other:.....

### Waste classification

#### a. LLW

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

#### b. VLLW

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

#### c. ILW

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 57. Radioactive Waste conditioning

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 58. Radioactive Waste packaging and logistics

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 59. Characterization and survey of containerized radioactive waste

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

### 60. Material clearance

#### a. Methodology and procedures

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

#### b. Instrumentation and logistics

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

61. Management of hazardous and toxic (asbestos, PCB, etc.)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

62. Conventional material recycling (circular economy)

IMPORTANCE:  1  2  3  4  5  6  7  8

URGENCY :  1  2  3  4  5  6  7  8

*Comments on Decommissioning Waste Management Topical Area:*