ONDRAF/NIRAS

ROUTES Work Package

(characterisation, treatment, conditioning and long-term waste management)

Chris De Bock

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PRESENTATION STRUCTURE

- **Context** of ROUTES
  - Objectives
  - List of wastes considered CHALLENGING
- **Structure** of ROUTES
  - Tasks, subtasks
  - Belgian partners involved
- **Methodology** followed
- **Results**
  - ROUTES recommendations for future R&D and collaboration
  - Applicability to the Belgian context
    - General
    - Overview of ROUTES Deliverable Reports
    - ROUTES recommendations for 'NO REGRET' waste management measures

CONTEXT OF ROUTES

- ROUTES is one of the two strategic studies as part of EURAD
- Subject of study: waste management routes ('from cradle to grave') in Europe, with focus on 'challenging' wastes (see next slide)
- Objectives of ROUTES
    1. Opportunity to **share experience and knowledge** on waste management routes between interested organisations (from different countries, with programmes at different stages of development, with different amounts and types of radioactive waste)
    2. Identify safety-relevant issues and their **R&D needs** associated with the waste management routes, including routes of legacy and historical waste, considering interdependencies between all stages of waste management
    3. D**escribe and compare** the different approaches to characterisation, treatment and conditioning and to long-term waste management, and identify **opportunities for collaboration** between member-states.

CHALLENGING WASTES

Wastes considered ‘challenging’ within ROUTES

1. Sludges
2. SIERs (spent Ion exchange resins)
3. Organic waste
4. Bituminized waste
5. Graphite waste
6. Decommissioning waste
7. DSRs (disused sealed radiation sources)
8. Particular spent fuel
9. Radium/thorium/uranium-bearing waste
10. Waste containing reactive metals
11. Waste containing chemotoxic substances

ROUTES STRUCTURE (TASKS)

- Task 1 - **Coordination**
- Task 2 - Identification of **challenging wastes**
- Task 3 - **Characterization** approaches
- Task 4 - **WAC** (1)
- Task 5 - Waste management solutions for small amounts of wastes, focusing on **SIMS** (2)
- Task 6 - **Shared solutions** for characterization, treatment, storage and disposal
- Task 7 - Interactions with **Civil Society**
- Task 8 - **ROUTES Extension** (Evaluation of possible waste management solutions in case of small inventory and absence of WAC)

(1) WAC = Waste Acceptance Criteria

(2) SIMS = Small-Inventory Member States

ROUTES STRUCTURE (SUBTASKS)

- Task 1 - Coordination
- Task 2 - Identification of challenging wastes
  - **Subtask 2.1** (Collection and analysis of existing work on categorization and classification of radioactive waste)
  - **Subtask 2.2** (Understanding at EU level of the practical issues on RWM routes for challenging waste)
- Task 3 - Characterization approaches
  - **Subtask 3.1** (Radioanalytical characterisation of radioactive waste and waste with complex/toxic properties)
  - **Subtask 3.2** (Characterization and segregation of legacy waste)
- Task 4 - WAC
  - **Subtask 4.1** (Current use of waste acceptance criteria)
  - **Subtask 4.2** (Sharing experience on waste management with/without WAC available)
  - **Subtask 4.3** (R&D needs and opportunities of collaboration)

ROUTES STRUCTURE (SUBTASKS)

- Task 5 - SIMS
  - **Subtask 5.1** (Collecting and analyzing actual existing knowledge about disposal options for SIMS)
  - **Subtask 5.2** (Describe the necessary predisposal routes for the disposal options of subtask 5.1)
- Task 6 – Shared Solutions
  - **Subtask 6.1** (State-of-the-art on shared development and use of technologies and facilities)
  - **Subtask 6.2** (Case studies on shared development and use of technologies and facilities)
  - **Subtask 6.3** (feasibility of developing further European shared solutions for cradle to grave waste management)
- Task 7- Civil Society
  - **Subtask 7.1** (Scoping and development of action plan for interaction with Civil Society)
  - **Subtask 7.2** (Implementing the action plan)
  - **Subtask 7.3** (Synthesis and dissemination)
- Task 8 – ROUTES extension
  - **Subtask 8.1** (qualitative analysis of predisposal routes)
  - **Subtask 8.2** (qualitative analysis of disposal options)

BELGIAN PARTNERS INVOLVED IN ROUTES

- **Partners involved**

- **Involved ROUTES Tasks**

TASK 1	Coordination			ONDRAF/NIRAS
TASK 2	Identification of challenging wastes	BEL Belgian TSO	sck cen	ONDRAF/NIRAS
TASK 3	Characterization approaches		sck cen	ONDRAF/NIRAS
TASK 4	WAC			ONDRAF/NIRAS = Task co-leader
TASK 5	SIMS			ONDRAF/NIRAS
TASK 6	Shared solutions			
TASK 7	Civil Society			
TASK 8	ROUTES extension			ONDRAF/NIRAS

METHODOLOGY

- **Structured steps**: initial data gathering → inclusive workshops → detailed analysis
- Alle ROUTES tasks initiated with a **data gathering and analysis phase**

  This phase entailed surveys, workshops, and case studies

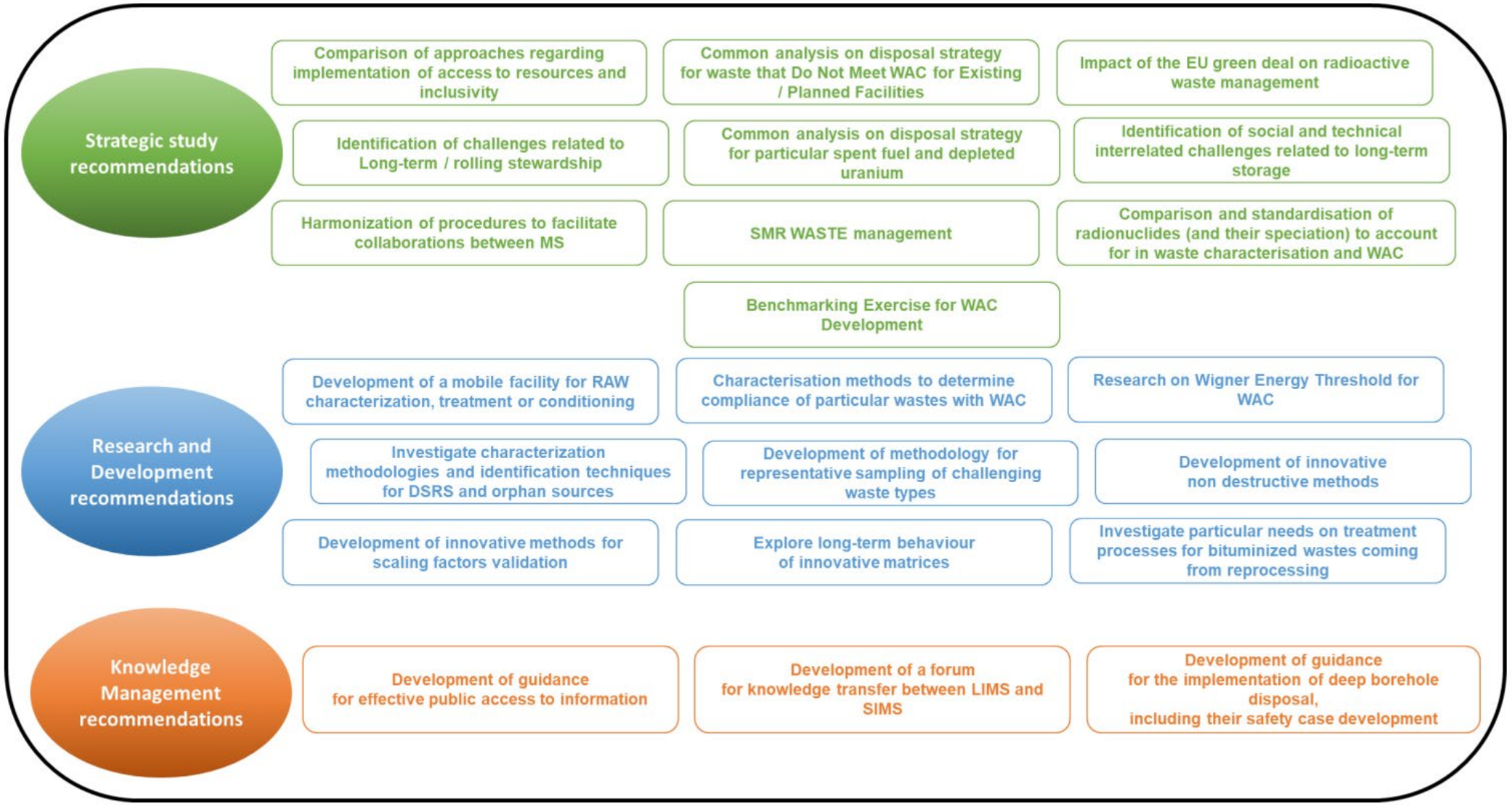
  - Collecting information on national waste classification, inventory, practices regarding predisposal steps and disposal facilities, and related aspects
  - **Compilation of information and analysis results in milestones and deliverables**
- **Inclusive workshop approach**
  - Facilitating collaboration among a diverse array of stakeholders
  - Pivotal forums for partners with various backgrounds (SIMS and LIMS alike)

    → Diverse perspectives are comprehensively considered

    → **Holistic and inclusive recommendations that reflect the broader societal context**
  - A dedicated workshop, convened in December 2022, served as a focal point for deliberating and refining recommendations generated within the project

    → ROUTES recommendations fed into the **EURAD-2 Strategic Research Agenda**

R&D needs and opportunities for collaboration
(ROUTES recommendations)



APPLICABILITY TO THE BELGIAN CONTEXT

- Recommendations for future R&D, strategic studies and KM

  → Offer opportunity for R&D and strategic studies in a **European collaborative context**

    → Scale benefits, benchmarking, networking

- Descriptions and comparative summaries of the different approaches to waste management in European countries (characterisation, treatment, conditioning, long-term management)

  → **State-of-the-art overview** of approaches to managing challenging wastes in EU

- Case analyses and treatment of specific cross-cutting topics

  → Examples of dealing with **specific** waste management challenges

- General recommendations

  → **Guidance/inspiration** in waste management dilemmas (e.g. early/late conditioning)

- Awareness of the importance of interaction with **Civil Society**

DELIVERABLE REPORTS

(available on the EURAD website https://www.ejp-eurad.eu/publications)

- **Task 1 – Coordination**
  - **D9.3** “ROUTES Recommendations for R&D, strategic study and KM activities”
- **Task 2 – Challenging wastes**
  - **D9.4** “Overview of existing work on categorization/classification of RWs in participating states”
  - **D9.5** “Overview of issues related to challenging wastes”
- **Task 3 – Characterisation**
  - **D9.7** “Review of radioanalytical characterisation of selected radioactive wastes and wastes with complex chemical and toxic properties”
  - **D9.8** “Review of characterisation of legacy and historical wastes”

DELIVERABLE REPORTS

- **Task 4 – WAC**
  - **D9.9** “Suggestions for the management of challenging wastes”
  - **D9.1** “Training Materials” (on the joint ROUTES-PREDIS Summer School on WM, September 2023 in Prague)
- **Task 5 – SIMS**
  - **D9.10** “Collection and analysis of actual existing knowledge about disposal options for SIMS”
  - **D9.11** “Results of the workshop dealing with possible conditioning routes for SIMS”
- **Task 6 – Shared Solutions**
  - **D9.12** “Studies and plans for developing shared solutions for radioactive waste management in Europe”
  - **D9.13** “Case studies on shared solution between Member states”
  - **D9.14** “Feasibility of developing further European shared solutions for waste management from cradle to grave”

DELIVERABLE REPORTS

- **Task 7 – Civil Society**
  - **D9.19** “Synthesis of Task 7 activities” (encompasses D9.15, D9.16, D9.17 and D9.18)
- **Task 8 – ROUTES extension**
  - **D9.21** (Report on Evaluation of existing predisposal routes for SIMS with regard to disposal options)
  - **D9.22** (Summary report on analysis, assessment and evaluation of disposal options for SIMS)

'NO REGRET' WASTE MANAGEMENT MEASURES

- **D9.9** (Task 4) contains recommendations for 'no regret' measures in all management route phases (characterisation, treatment, conditioning, storage, disposal)
  - Figure below summarizes pros & cons of **early versus delayed conditioning**
  - Repackaging without matrix conditioning can provide a flexible and reversible intermediate solution