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SNETP Forum

SUDOKU: Near-Surface Disposal Optimization Based on Knowledge and Understanding

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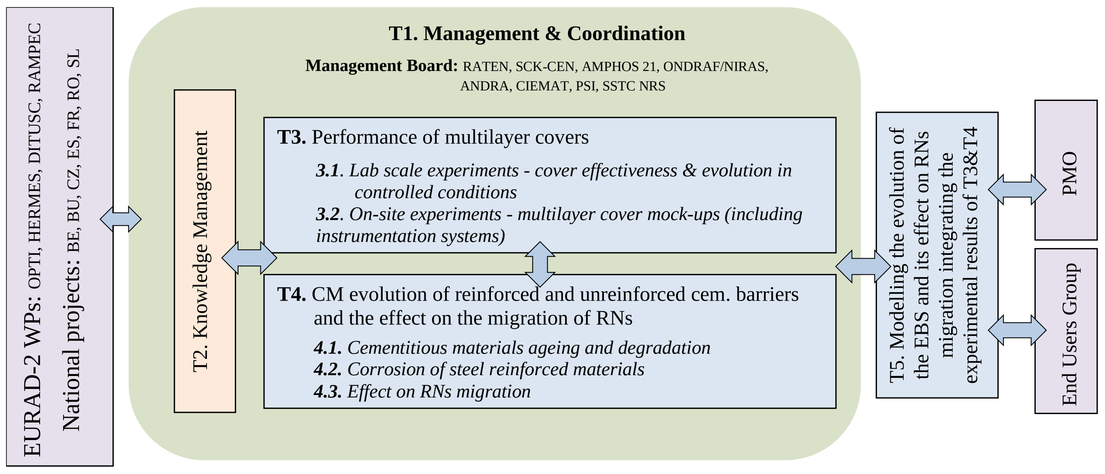
In some European countries, the current focus of the national radioactive waste management programme is on preparing for near-surface disposal of short-lived LILW. In other countries, where such repositories are already in operation, the main focus is on the optimization of the multilayer cover. The EURAD-2 WP SUDOKU aims to deepen the current understanding of the behaviour and performances of multilayer covers and cementitious barriers in near-surface repositories. The SUDOKU approach combines experimental and site investigations on multilayer covers, durability studies of cementitious barriers and diffusion tests to assess the transport of mobile radionuclides (C-14, Cl-36, I-129, Tc-99) in damaged cementitious barriers considering their chemo-mechanical evolution.

Objectives:

- Optimization of multilayer cover design by understanding the processes that:
  - control infiltration
  - influence the cover efficiency and its long-term performance (erosion, material degradation, layer configurations ....)
- Evaluate the consequences of the chemo-mechanical degradation of cementitious engineered barrier systems on transport parameters (mainly diffusion coefficient)
- Evaluate the effect of multilayer cover performance and cementitious barriers degradation on long-lived radionuclide release from the disposal system through numerical modelling



Task 2. Knowledge management

Capture knowledge existing prior to EURAD-2 and gained during SUDOKU: Initial and updated State of the Art on engineered barriers of near-surface disposal facilities

Transfer of knowledge by organizing on-line or face-to-face trainings, e-learning materials, workshops, posts for social media, in cooperation with Knowledge Management WP

Task 3. Performance of multilayer covers

Aim: To improve the current knowledge of **processes that control infiltration in multilayer covers** for surface disposal facilities and **to evaluate cover effectiveness and its long-term performance**

Means of achieving:

- **Laboratory scale experiments** to study under controlled conditions the **behaviour** of individual layers or combinations of **layers** that form the cover
- Performing **in-situ tests** and **monitoring** on under construction and existing multilayer cover mock-ups

Expected outputs:

- Better understanding of the **behaviour** and **evolution of different multilayer cover concepts**
- **Recommendations** regarding **design optimisation, construction and monitoring** of multilayer covers

Task 4. Chemo-mechanical evolution of reinforced and unreinforced cementitious barriers and the effect on the migration of mobile RNs

Aim: To improve the knowledge on the **chemo-mechanical degradation of cementitious engineered barrier systems** and to evaluate its **consequences on radionuclide migration** for the conditions of near-surface disposal facilities

Means of achieving:

- investigating the **coupling of mechanical constraints and chemical alterations** on unreinforced cement-based materials (mortar and concrete) for characterizing the consequences for cementitious matrix including aggregates
- Investigating similar systems with steel reinforcement for characterizing the **effect of corrosion** in terms of cracking and diffusion of corrosion products
- Studying the **migration of mobile radionuclides in degraded** cementitious materials

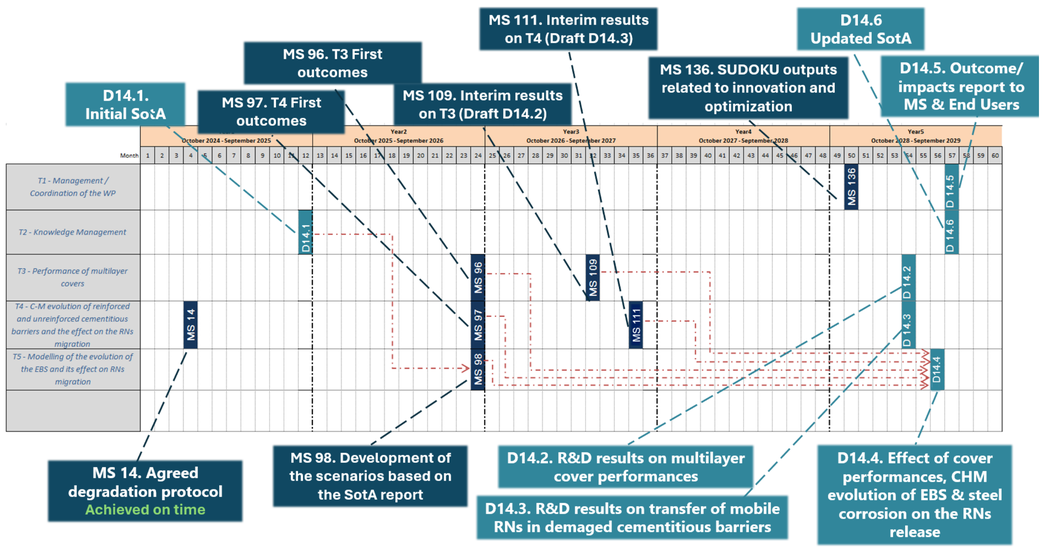
Expected outputs:

- Better understanding the **mechanisms driving the degradation** and the **effect** of degradation on **mechanical and transport properties**
- Better understanding of **damages induced by the corrosion of steel reinforcement bars** including **characterization of corrosion processes** and the **initiation of cracking**
- Quantification the effect of **cement degradation** on **radionuclides diffusion**

Agreed protocols for sample degradation have been established (MS14)

Task 5. Modelling of the evolution of the EBS and its effect on radionuclide migration using the experimental results obtained in Tasks 3 and 4

Aim: To assess the **effects of the multilayer cover performance** and **cementitious barriers degradation on radionuclide migration** in the disposal system integrating experimental results from Task 3 and Task 4.



Conclusion

The combination of **on-site** and **laboratory studies** with **state-of-the-art numerical models** will ensure the necessary **reliability of the SUDOKU results** and facilitate the **elaboration of recommendations for optimal Engineered Barrier System (EBS) design from the safety point of view.**

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