

# DEVELOPMENT AND IMPROVEMENT OF THERMODYNAMIC UNDERSTANDING FOR USE IN NUCLEAR WASTE DISPOSAL SAFETY CASE



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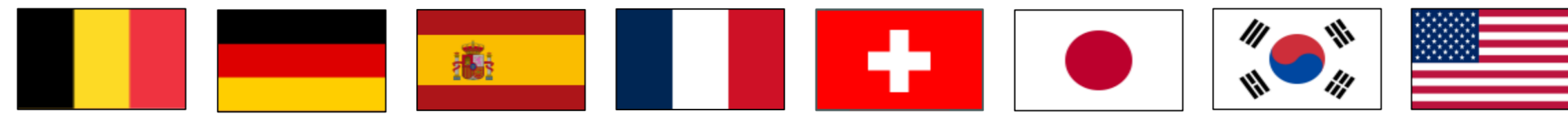
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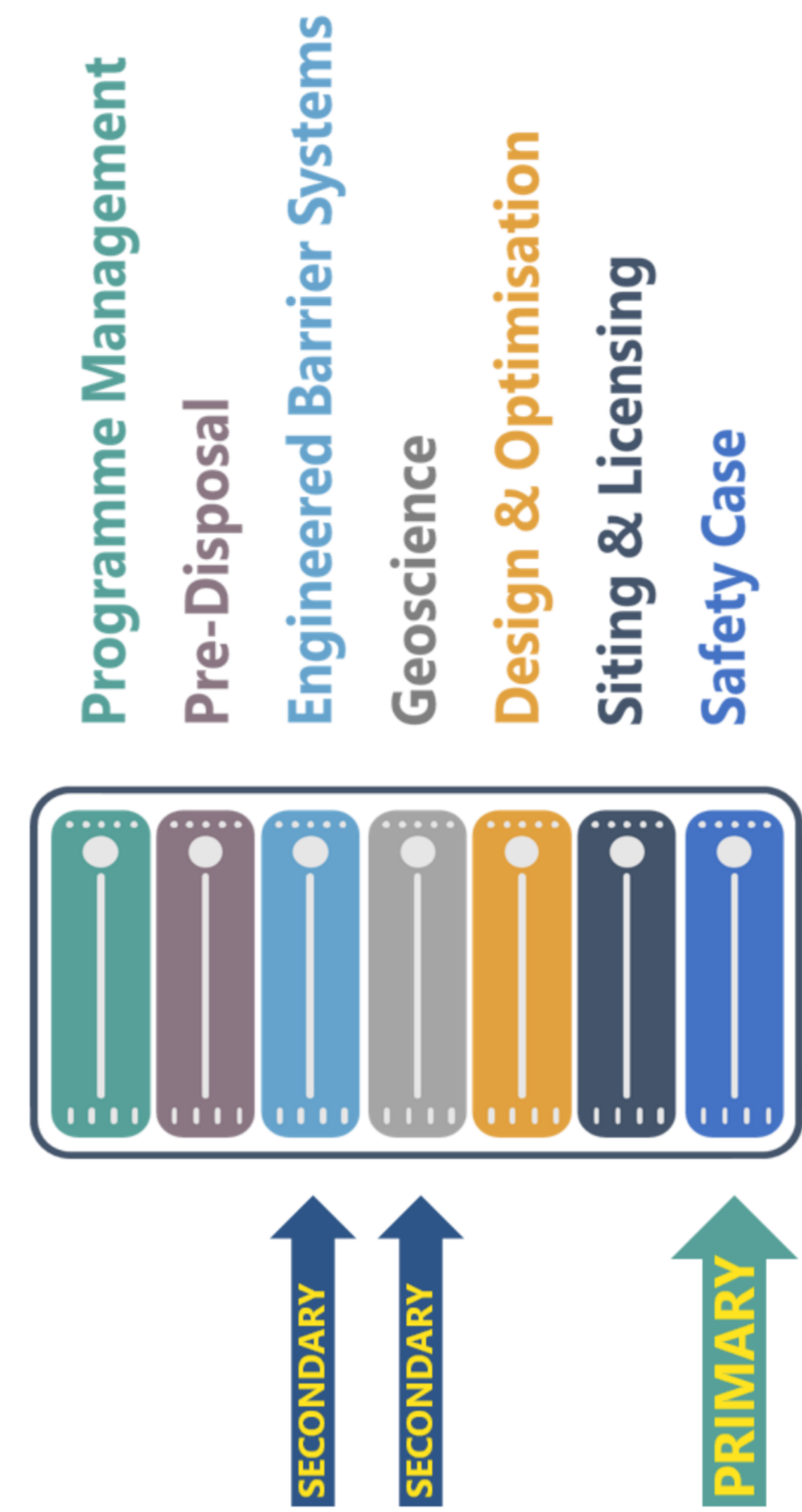


## INTRODUCTION

**Development and Improvement of Thermodynamic Understanding for use in nuclear waste disposal Safety Case (DITUSC)** is a work package within the Eurad-2 project. This initiative has been designed as a **24-month strategic study** with the primary goal of consolidating and enhancing scientific knowledge to predict long-term safety-relevant processes in the disposal of radioactive waste. DITUSC is linked to the overall EURAD-2 roadmap, with a primary **focus on the Safety Case** and a secondary focus on knowledge related to Engineered Barrier Systems and Geoscience.

A total of **18 actors** from 8 countries, of which 4 are EC Member States, are involved in DITUSC. The European contribution is carried out by 12 partners, including 2 Waste Management Organizations, 2 Technical Safety Organizations and 8 Research Entities. The Non-European contribution is provided by 6 Associated Partners.

An **End-User Group** (i.e. waste owners, waste generators, waste management organizations, regulators) will be established to evaluate the scientific output of DITUSC, but also to ensure that future priorities are appropriately set.



## WP BREAKDOWN

**Task 1 - Management / Coordination of the WP – ONDRAF/NIRAS & KIT**

- T1.1. S/T coordination
- T1.2. Dissemination / outreach / impact
- T1.3. Quality control

**Task 2 - Knowledge Management – JFZ**

- T2.1. Knowledge capture
- T2.2. Knowledge transfer

**Task 3 - Thermodynamics: data gaps, solid-solutions, interlink with kinetics, and Safety Case – A21 & PSI**

- T3.1. Thermodynamic data gaps for RNs and organics
- T3.2. Perturbed systems (high saline systems and high temperature)
- T3.3. Thermodynamics of solid-solutions
- T3.4. Interplay of thermodynamics and kinetics
- T3.5. Thermodynamics and Safety Case

## OBJECTIVES

*Assessment of the current thermodynamic understanding in support of the Safety Case for radioactive waste disposal, with particular emphasis on a transversal understanding to allow identification of possible future improvements in knowledge and use.*

- **Complementarity/synergies** with on-going thermodynamic projects, e.g., NEA-TDB, ThermoChimie, THEREDA, PSI/Nagra TDB, JAEA-TDB, WIPP TDB, Thermodem, Prodata etc;
- In close collaboration with the End-User Group, identify, critically assess and prioritize data gaps of relevance to the **Safety Case**;
- Definition of technical approaches and possible scientific strategies to fill in the identified **thermodynamic data gaps**;
- **Collaborative work and scientific awareness** will be organized through surveys, exchange meetings, open workshops and training courses;
- **Green Paper** framing the scope of interactions and take position on several topics relevant to use of thermodynamics in radioactive waste management;
- **White paper** summarizing the outcomes of the integral assessment and promoting new valuable R&D actions to further support/improve the use of thermodynamics in the SC.

## WORKSHOPS

**3 special workshops** open to any interested parties

### I. November 2024 – Spain

- (i) Exchange with on-going TDB programs
- (ii) Introduction to DITUSC Survey

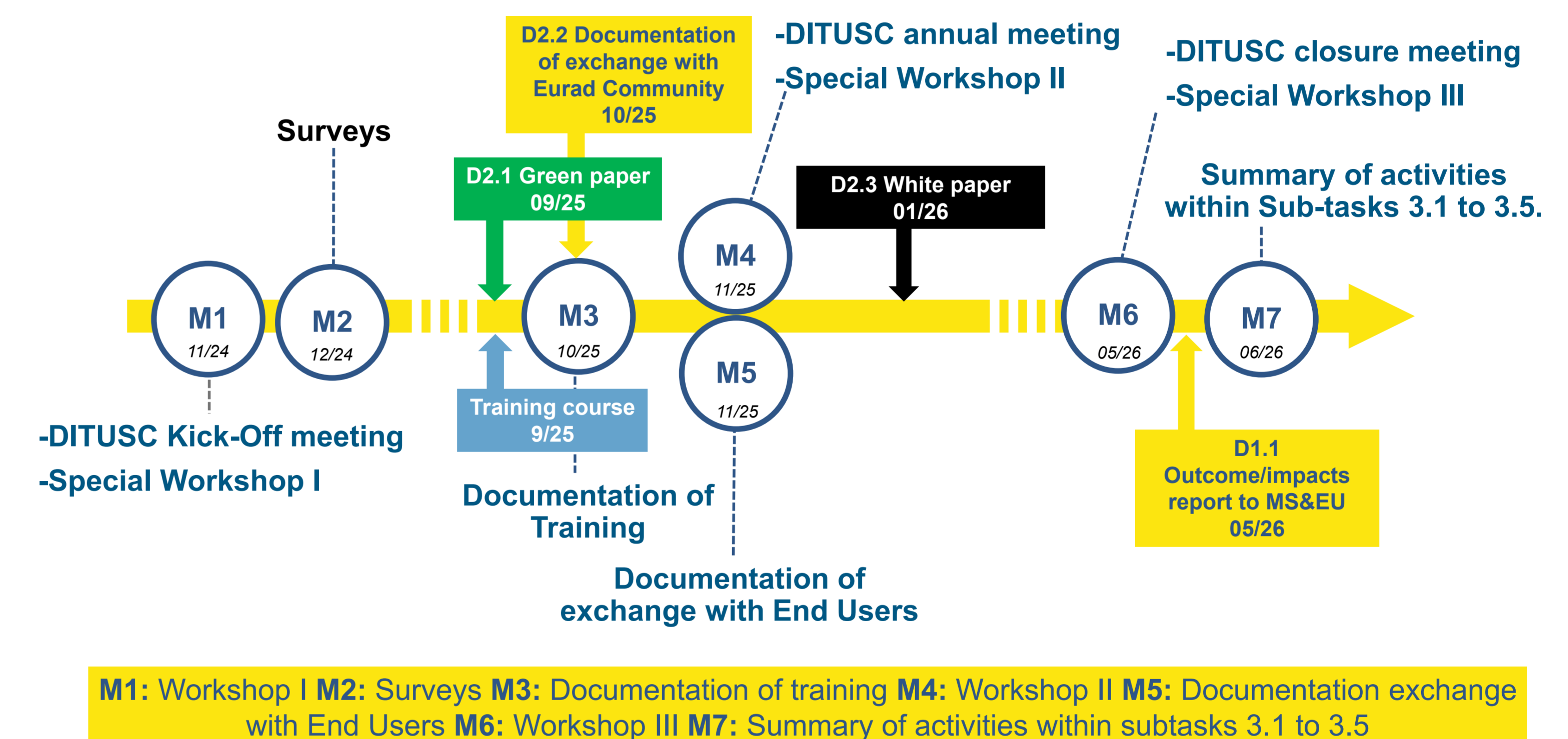
### II. Fall 2025 – France

- (i) Feedback survey
- (ii) Identification and prioritization of knowledge gaps and current limitations of use in the Safety Case

### III. Spring 2026 – Belgium

- (i) Thermodynamics and kinetics
- (ii) Thermodynamics and OM
- (iii) Thermodynamics of solid-solutions

## TIMELINE



## DITUSC SURVEY

A **survey** (implemented on [www.eusurvey.com](http://www.eusurvey.com)) has been organized in DITUSC to capture the actual needs of the stakeholders, the underlying requirements and the related use of thermodynamics in the Safety Case. It consists of two distinct parts. The so-called **START** survey, focused on the use of the thermodynamic database **in support of research activities**, and the **SAFE** survey, focused on the **use of thermodynamics in the Safety Case**.

## CONCLUSION AND OUTLOOK

As a strategic study, **DITUSC** aims to bring together various stakeholders in radioactive waste management to organize a **forum for the exchange** of current thermodynamic understanding relevant to the safety case (and its supporting R&D program). The objective is to enable a **consensus to be reached across the community** on key issues, and in particular on the current limitations of knowledge and use in the **Safety Case**.

The results of this transversal and integrated exchange will be documented in **two reference documents** to frame possible further efforts in thermodynamics applied to radioactive waste management and disposal in particular. A first **Green Paper** will be published in the third quarter of 2025, containing several common positions on key aspects, while a **White Paper** will be published in the first quarter of 2026, containing a prioritized list of possible further improvements.



Co-funded by the European Union under Grant Agreement n° 101166718

