



EURAD-2-WP GEOSCALE

***GEOSPHERE MODELS AS A TOOL FOR
IMPROVING CONFIDENCE IN SITE
CHARACTERIZATION AND ASSESSMENT
FOR LONG-TERM EVOLUTION AND SAFETY***



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GEOsphere MODELS AS A TOOL FOR IMPROVING CONFIDENCE IN SITE CHARACTERIZATION AND ASSESSMENT OF LONG-TERM EVOLUTION AND SAFETY (GEOSCALE)



- Advancing modelling approaches and data needs for geosphere flow and transport models
- Establish shared reference sites and benchmarks to systematically compare models
- Improving credibility and robustness of geosphere assessments for siting and safety cases

Organization	College	Country
AGES	TSO	Austria
Amphos21	RE	Spain
ASNR	TSO	France
Bel V	TSO	Belgium
BASE	TSO	Germany
BGE	WMO	Germany
BGR	RE	Germany
CTAB	RE	Sweden
EGIS	RE	France
EIMV	TSO	Slovenia
ENEA	RE	Italy
ENRESA	WMO	Spain
GFZ	RE	Germany
GRS	TSO	Germany
GTK	RE	Finland

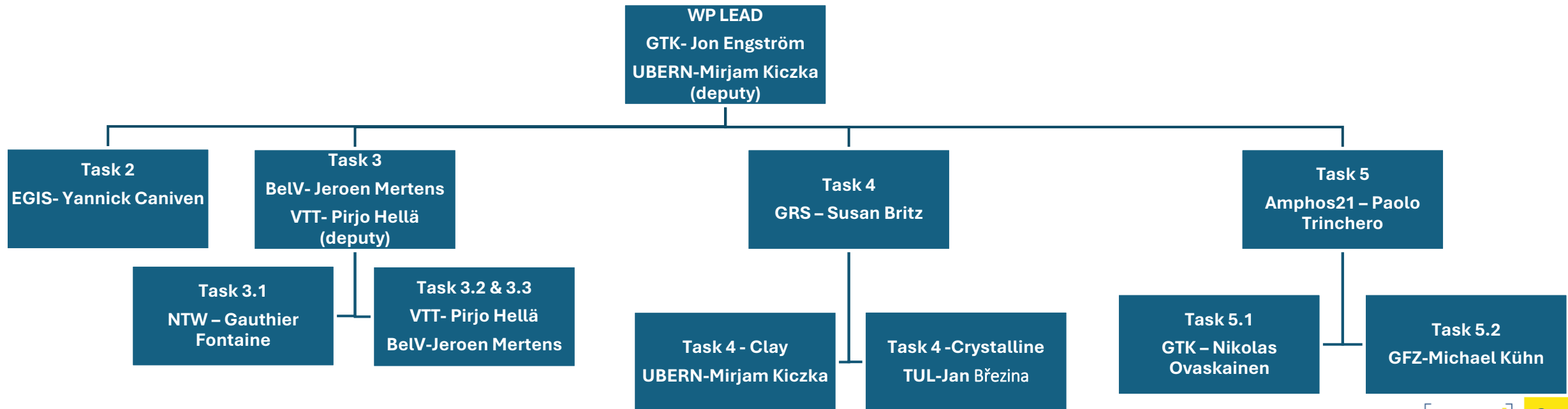
Organization	College	Country
LEI	TSO	Lithuania
NAGRA	WMO	Switzerland
NRG	TSO	Netherlands
NTW		International
NWS	AP	UK
POSIVA	TSO	Finland
PSI	AP	Switzerland
RATEN	RE	Romania
SKB	WMO	Sweden
SOGIN	WMO	Italy
SSM	TSO	Sweden
SURAO	WMO	Czech Republic
TUL	RE	Czech Republic
UBERN	RE	Switzerland
VTT	TSO	Finland

- 30 organizations participating or following the outcome
- 15 different countries involved

GEOSCALE – TASK DESCRIPTION



- Task 1** Management and coordination of the WP
- Task 2** Knowledge Management, SotA and Webinar
- Task 3** Geosphere functions, processes and parameters with respect to long term safety for the development of reference sites
- Task 4** Development and benchmarking of geosphere models in crystalline and clay host rock
- Task 5** Approaches and scenarios for complex modelling environments, coupling of subsidiary models and model evolution with evolving data generation



TASK 2: KNOWLEDGE MANAGEMENT

Subtask 2.1: Development of documentation materials (SotA, gap analysis)

- Initial State-of-the-Art report on geosphere modelling practice, with gap analysis feeding benchmark definition
- Updated SotA near the end of the WP
- FAIR-oriented management of benchmark documentation, datasets and code references

Subtask 2.2: Training materials

- Webinar presenting the modelling approaches and benchmark cases
- Matrix mapping approaches and benchmarks to available codes and tools
- Workshop and guideline documents for stakeholders and young scientists

➤ OUTCOME:

- **Benchmarks, reference sites and modelling approaches made accessible beyond EURAD-2 through the EURAD-2 KM system**
- **Supports early-stage programmes and young scientists in choosing codes and approaches suited to their programme maturity**

TASK 3: GEOSPHERE FUNCTIONS, PROCESSES AND PARAMETERS WITH RESPECT TO LONG TERM SAFETY FOR THE DEVELOPMENT OF REFERENCE SITES

Subtask 3.1: Enhancing robustness and transparency in safety assessment through in-depth analysis of siting processes (in relation to geosphere models)

- Stakeholder and civil society engagement

Subtask 3.2: Definition of parameters, processes and scenarios for site descriptive flow and transport models for clay and crystalline host rocks

- Definition of the parameters, processes and scenarios for benchmark and input for guideline documents

Subtask 3.3: Development of reference sites for flow and transport modelling

- Definition of generic and real reference sites to be used in the benchmarks

➤ OUTCOME:

- Describes reference-site properties, parameters and long-term evolution, supporting transparent communication with stakeholders and the public
- Establishes a framework for investigating the complexity of the relationship between geosphere modelling and siting processes in the context of Safety Assessment

TASK 4: DEVELOPMENT AND BENCHMARKING OF GEOSPHERE MODELS IN CRYSTALLINE AND CLAY HOST ROCK

Subtask 4.1 - 4.3 Building modelling approaches for a simple generic (Model A), an advanced generic (Model B) and for real reference site(s) (Model C)

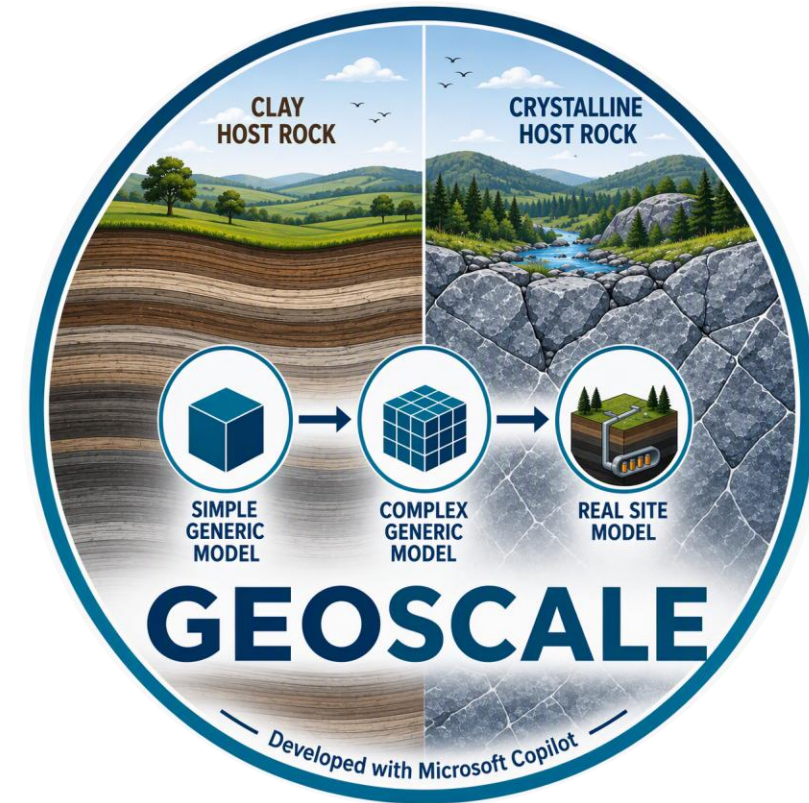
- Definition of workflow for implementation of changing boundary conditions on local flow and transport processes
 - Implementation of benchmark scenarios for long-term evolution (e.g. erosional stages during landscape evolution)
 - Evaluation of approaches and codes

Subtask 4.4 Evaluation of the different modelling approaches and software for the benchmark scenarios

- Recommendation of approaches and code abilities/capabilities

➤ **OUTCOME:**

- Establish generic, reference model approaches for site selection and code development
- Facilitates the comparison of various sites in an ongoing site selection process
- Provide internationally accepted workflow and code recommendations for geosphere models



TASK 5: APPROACHES AND SCENARIOS FOR COMPLEX MODELLING ENVIRONMENTS, COUPLING OF SUBSIDIARY MODELS AND MODEL EVOLUTION WITH EVOLVING DATA GENERATION



- **Subtask 5.1: Further approaches and scenarios for complex modelling environments and coupling of subsidiary models**
 - Testing of approaches of hydromechanical coupling and comparison of different approaches/models for DFN and upscaling methods to bridge scales of models
- **Subtask 5.2: Evolution of geosphere models with data generation**
 - Integration of real data from reference sites of different scales, interaction with WP STRATA-AI
 - Evaluation of Impact of minimum and extended datasets on uncertainty and quality of model predictions

➤ **OUTCOME:**

- **Best practices to integrate different borehole and geophysical data into geosphere models**
- **Develop EURAD aligned recommendations on selecting appropriate codes, datasets and models for acceptance in siting process and the safety case for a DGR**

- **State-of-the-Art report;**
 - Review of Geosphere Modelling and Simulation across Geological Disposal Programmes
- **Guideline Documents;**
 - Benchmark scenarios defined and documented as short guidelines
 - Definition of generic sites documented in short guidelines for further use
 - Definition of real reference sites documented in short guidelines for further use
- **Final Report WP GEOSCALE;**
 - Main achievements and impact on the role of geosphere models in radioactive waste disposal.
- **The Novelty aspect and main outcomes for WP GEOSCALE:**
 1. Increased understanding of Flow and Transport modelling of the geological barrier under FEPs
 2. Establishing codes and approaches for three levels of model complexity covering both clay and crystalline sites, with reference models and workflow
 3. Pathways from raw data (provided by STRATA-AI) down to uncertainty analysis for the safety case