

WP EBS MATERIALS

Innovative Engineered Barrier System materials for improved sustainability, passive safety and robustness

Public webinar, October 13th, 2026

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

Why EBS materials

Materials innovation for safety and sustainability



Objective

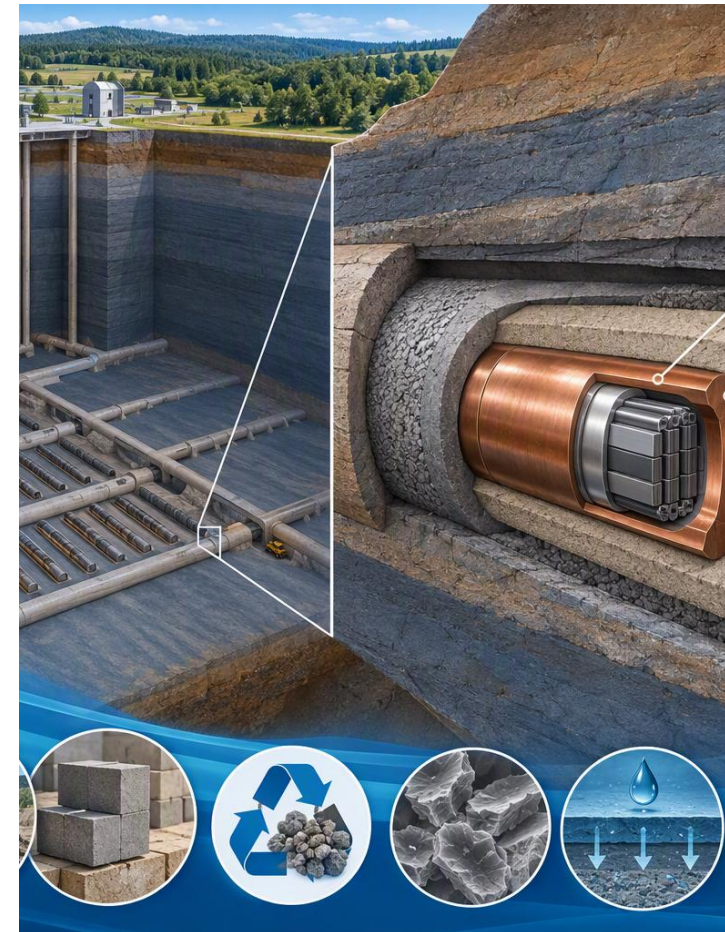
Develop **innovative**, **sustainable** materials and solutions that enhance the **robustness** and **passive safety** of disposal systems.



Guiding principle

Material **selection** is not assessed **in isolation**:

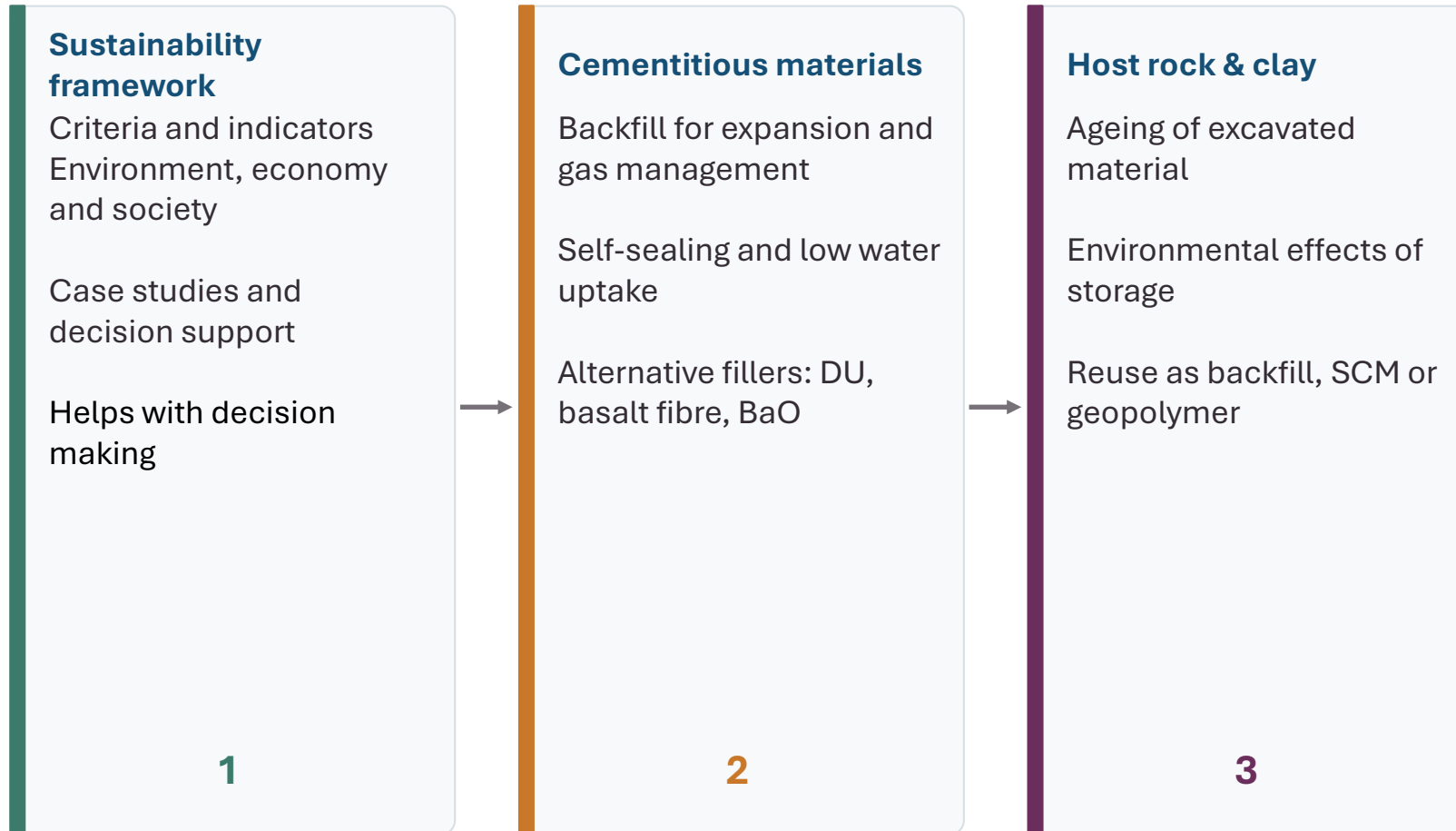
- technical performance,
- long-term safety and robustness,
- environmental impact, economic viability and societal aspects are considered together.
- Stakeholder requirements (WMO, regulators...)



EBS Materials

Technical focus

Three complementary research streams form the technical core



Common denominator:

sustainable material options with demonstrated **functionality** and clear end-user **relevance**.

Work package architecture

tasks: 2 supporting and 3 technical

T1

Management & coordination

GRS / SCK CEN

T2

Knowledge Management

UNIROMA1 / POLIMI

enable delivery, coordinate activities and assure quality

**T3 · Sustainability
Assessment**

SCK CEN / Amphos21

**T4 · Novel Cementitious
Backfill**

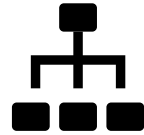
Energorisk / SCK CEN

**T5 · Host Rock Backfill /
Filling**

ASNR / ANDRA

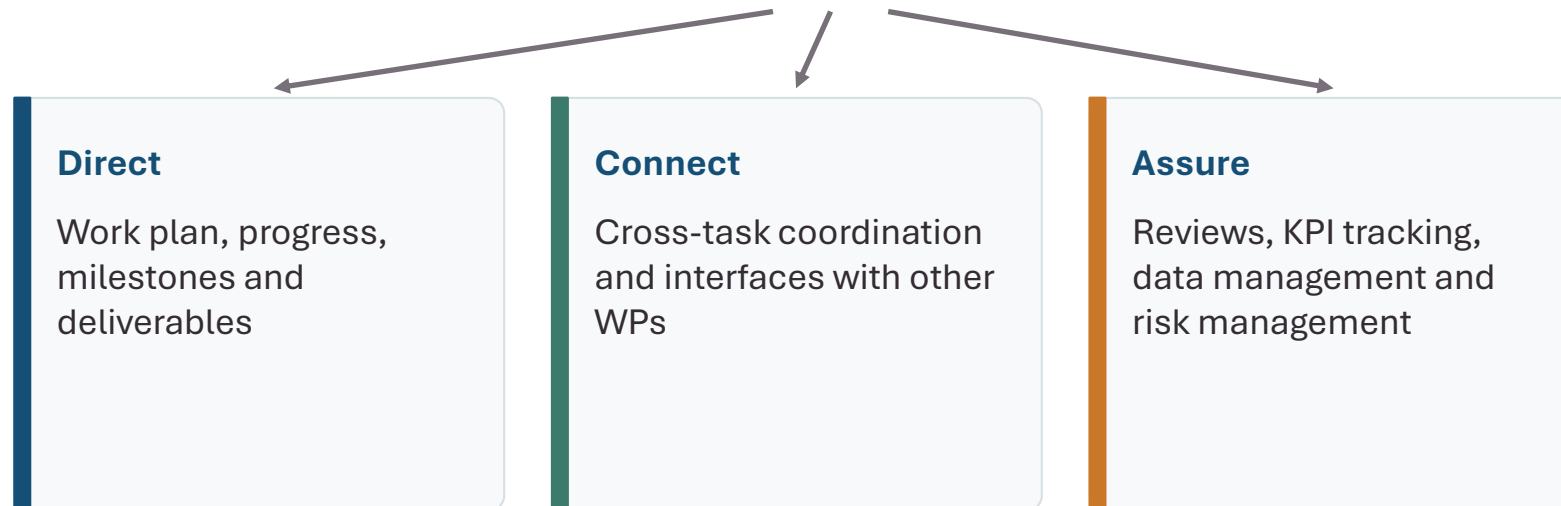
Organisation and governance

Clear responsibilities, regular coordination and documented quality assurance



WP Board

WP Lead + Co-Leads + Task Leads

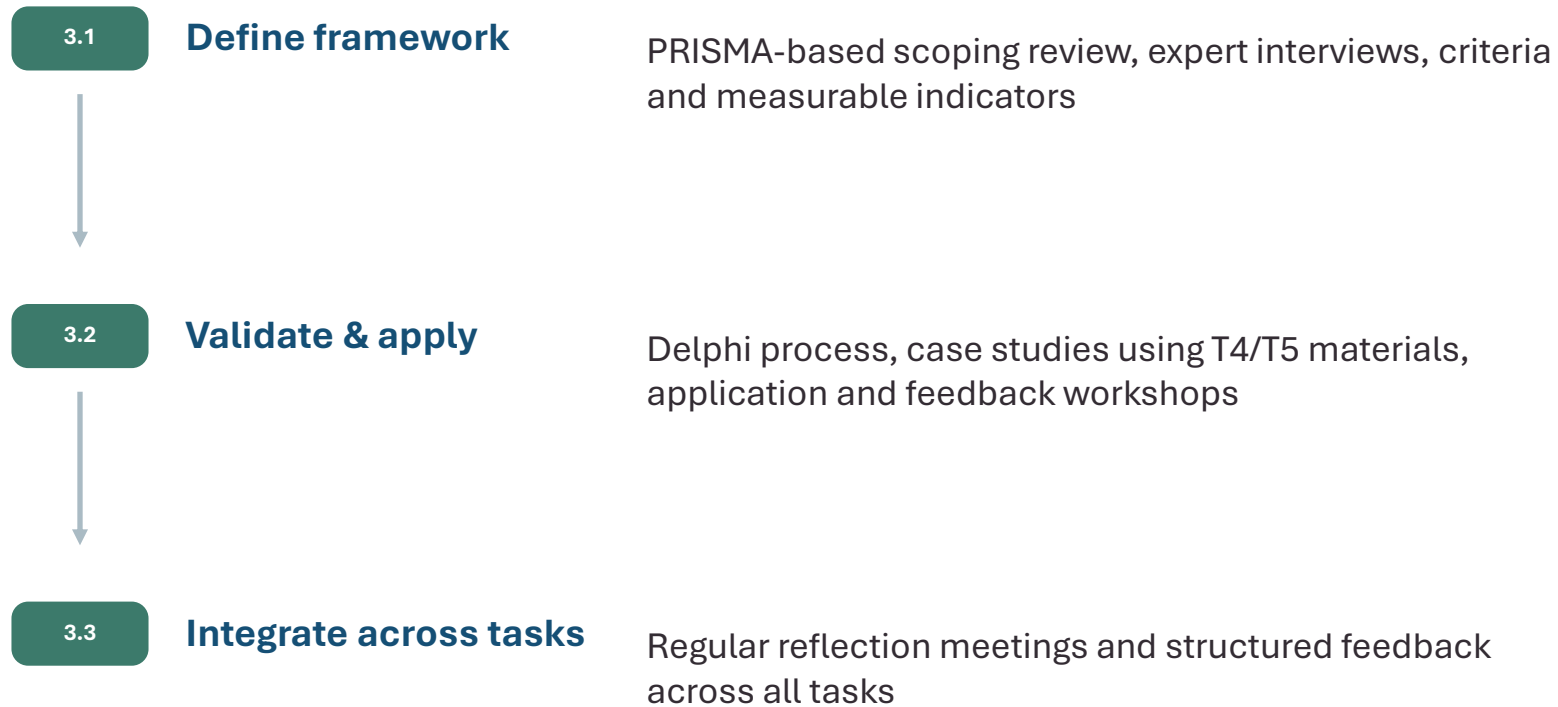


Communication cycle

Board meetings · Annual meetings · Task meetings · News at least twice per year

Task 3 – Sustainability Assessment

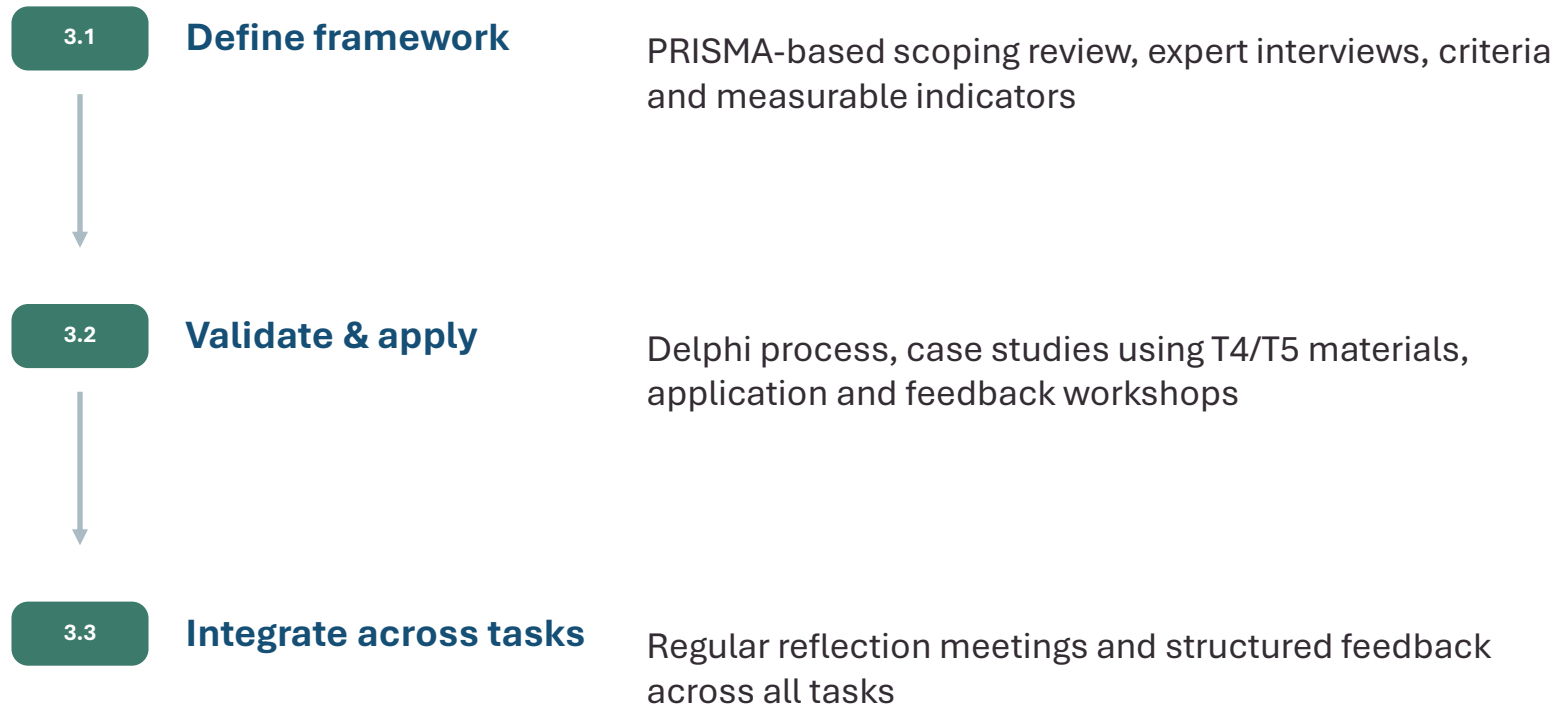
robust assessment framework for EBS material decisions



Output: validated assessment framework providing a transparent decision basis for end users

Task 3 – Sustainability Assessment

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Task 4 – Novel Cementitious Backfill

Material development for expansion, gas management, durability and shielding



T4.1 • Alternative backfill materials

- Modelling of target properties
- Laboratory development and validation
- Self-sealing, low capillary water uptake and gas absorption
- ML-supported experimental design



T4.2 • Fillers and raw materials

- U_3O_8 as a high-density aggregate
- Modified basalt fibres for crack control
- BaO as a partial CaO replacement
- Assessment of material performance and sustainability

Target:
Engineering solutions for specific
waste streams

Task 5 – Host Rock Backfill / Filling

From excavated material to a reliable local resource

T5.1 · Understand ageing

Chemical monitoring of acidification and trace-element release

Characterisation of fresh and long-term stored claystone

THMC experiments and reactive transport modelling

T5.2 · Repurpose clay material

Thermal and mechanical activation

SCM in blended cements and geopolymer precursors

Optimisation, production and material characterisation

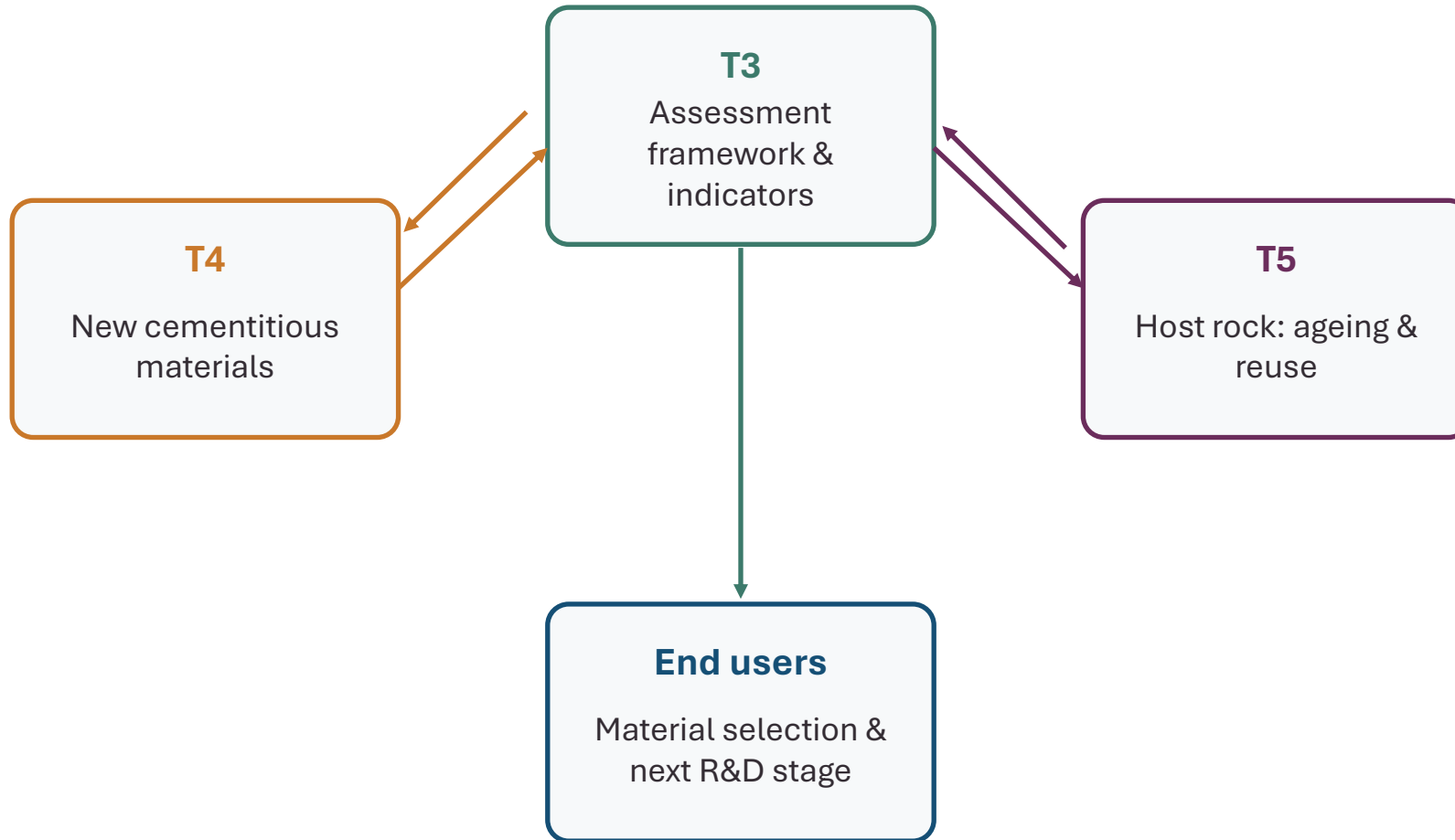


Target: less waste, reduced transport, local raw material and lower CO₂ footprint

How the task interacts

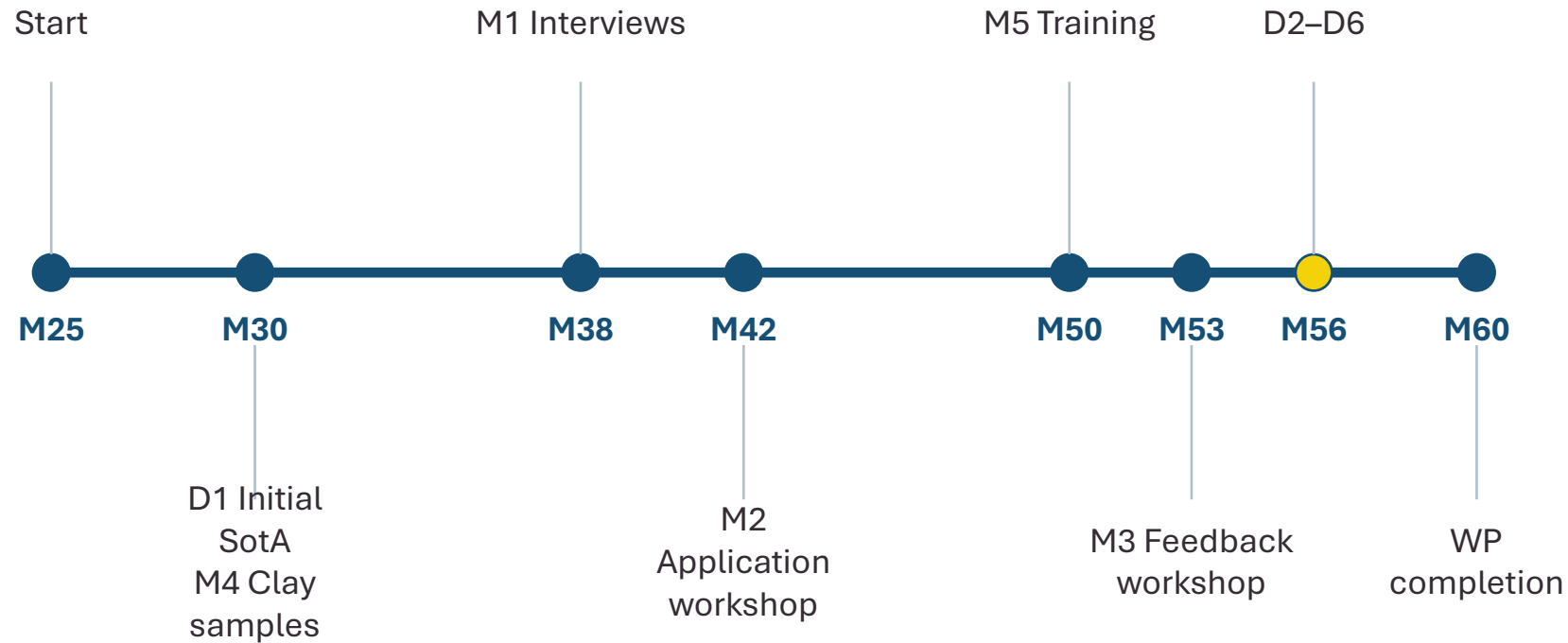
T1 coordinates · T2 consolidates and transfers knowledge into EURAD-2 KM

Technical development and sustainability assessment converge iteratively



Deliverables and milestones

Implementation period M25–M60, key results by M56



6 deliverables: SotA, innovative materials, host-rock reuse, sustainability framework and impact summary

Consortium and key figures

European network with broad technical and programme coverage

26 Partners

2 In-kind contributors

36 Months

344 Person-Months

5 Tasks

6 Deliverables

Complementarity

Research Entities · Technical Support Organisations · Waste Management Organisation · advanced and early-stage national programmes

Expected results and impact

From individual material options to a comparable decision basis



Assessment framework

Sustainability criteria and indicators tailored to EBS



New backfills

Materials for expansion, gas management and reduced water availability



Robust concretes

More durable and radiation-resistant cementitious materials



Local resources

Reuse and repurposing of excavated and waste materials



Ageing knowledge

Environmental impact and long-term compatibility of stored materials



Decision support

More transparent selection and prioritisation for national programmes



Acknowledgements

**Special thanks to the European Community
and
the local funding organizations**

Thanks to you all for listening