

WP11 – IMPACT OF CLIMATE CHANGE ON NUCLEAR WASTE MANAGEMENT (CLIMATE)

EURAD-2 Kick-off meeting

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EURAD-2 WP11: CLIMATE

Background

Climate evolution on millennial timescales or longer is a **main driver** of thermal conditions, regional sea level, local and regional geomorphological evolution, weathering processes, local and regional hydrogeological and hydrological conditions, and changes in natural and anthropogenic ecosystems.

Climate change is affecting the frequency and intensity of events (floods, landslides, snowstorms, tornadoes, etc.), which can lead to climate-related risks. This, in turn, has the potential to affect the safety of different types of nuclear waste management facilities during construction, operation, and post-closure phases, and have an impact on the public and the environment.

EURAD-2 WP11: CLIMATE

Objectives

EURAD-2 WP11 CLIMATE aims at identifying **knowledge gaps** and providing **recommendations** for future research needs on **the impact of climate change on radioactive waste management facilities and sites:**

- Predisposal;
- Surface, shallow, and near-surface disposal of low-level waste;
- Deep geological repositories for low and intermediate (LILW) and high-level waste (HLW)

During **construction, operation and post-closure** phases.



2 years duration



Total funding 999,943.2 €



107.25 funded person month (pm)

EURAD-2 WP11: CLIMATE PARTICIPANTS



21 funded partners



2 associated partners
(Nagra, Switzerland
and NWS, UK)



12 Research Entities (RE)



6 Waste Management
Organisations (WMO)



5 Technical Support
Organisations (TSO)



IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

NTW
NUCLEAR TRANSPARENCY WATCH

MINES PARIS

ANDRA
Agence nationale pour la gestion des

Géosciences pour une Terre durable
brgm

Nuclear Waste Services

sck cen

BGE
BUNDESGESELLSCHAFT
FÜR ENDLAGERUNG

GRS

**CENTER
FOR PHYSICAL SCIENCES
AND TECHNOLOGY**

**TURUN
YLIOPISTO**

MITTA

GTK

**SSTC
NRS**
STATE ENTERPRISE
STATE SCIENTIFIC AND TECHNICAL
CENTER FOR NUCLEAR AND
RADIATION SAFETY

SÚRAO

EIMV
ELEKTROINŠTITUT
MILAN VIDMAR

AMPHOS²¹
an RSK company

nagra

ENEA

Agenzia nazionale per le nuove tecnologie,
l'energia e lo sviluppo economico sostenibile

TECHNICAL UNIVERSITY
SOFIA

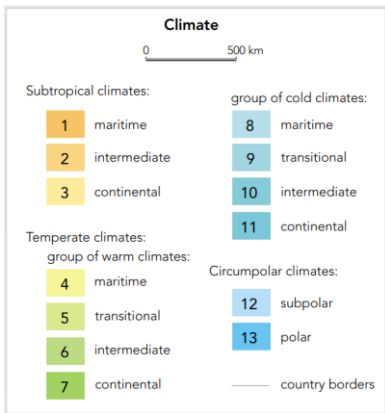
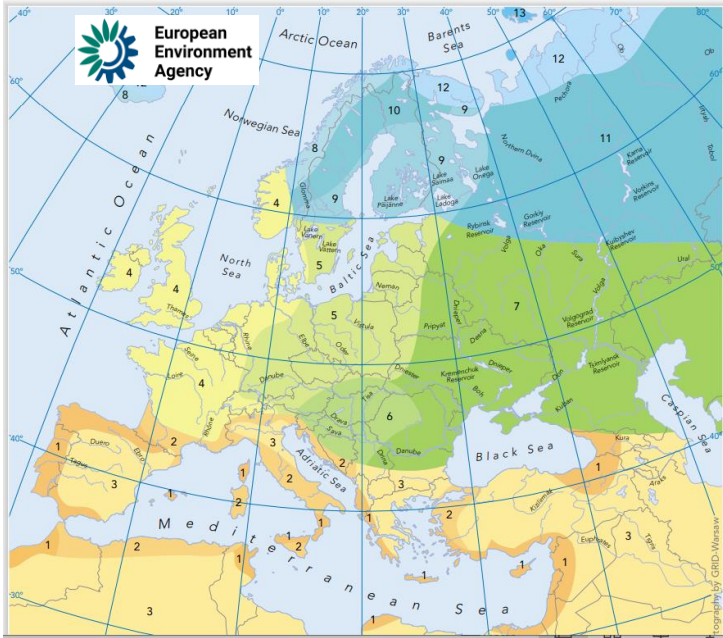
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Kick-off meeting

**GEOLOGICAL
INSTITUTE • BAS**

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24-10-2024

WP11 PARTNERS' CLIMATE



24-10-2024

EURAD-2 WP11 partners

- Cold
- Subtropical
- Temperate continental
- Temperate transitional
- Temperate maritime

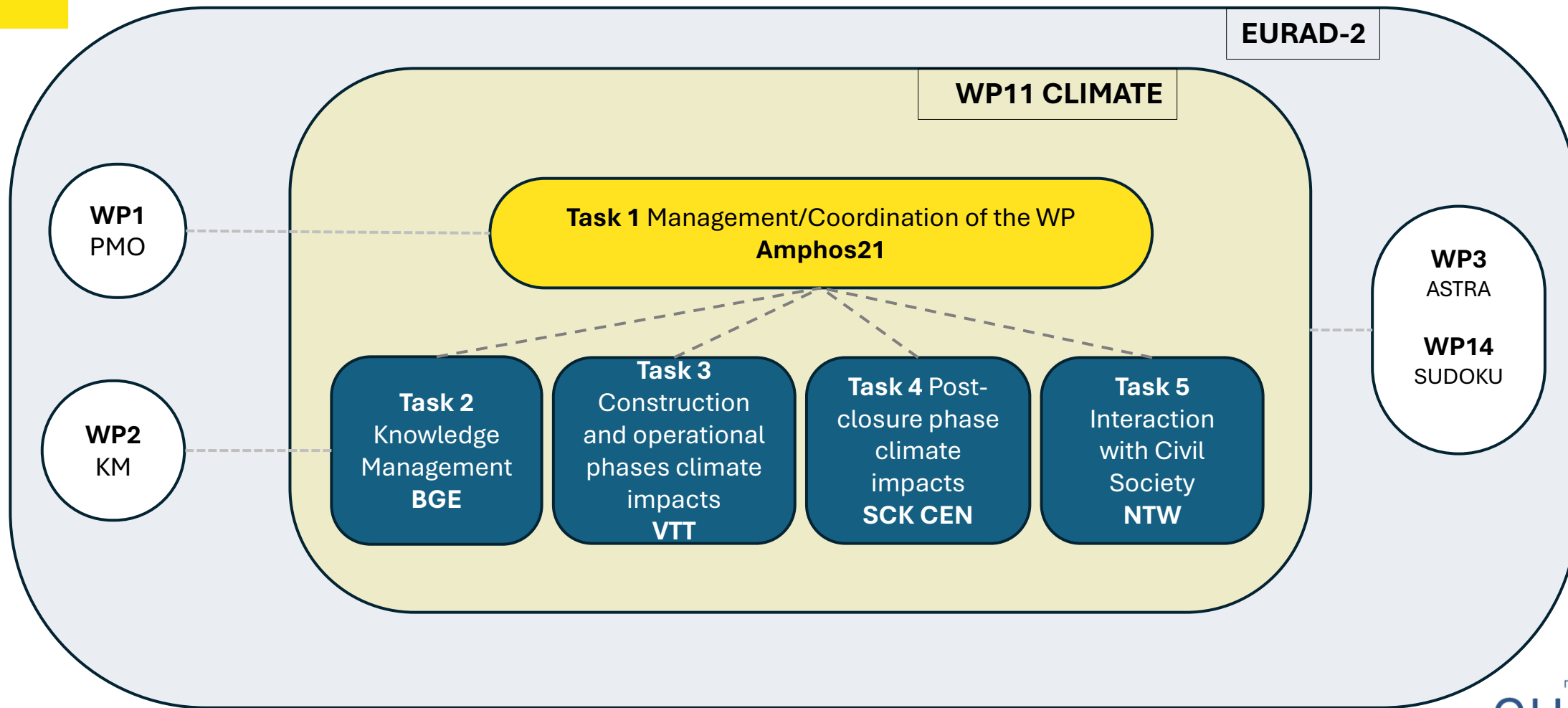


Source: *Main Climates of Europe* (European Environment Agency)
<https://www.eea.europa.eu/en/analysis/maps-and-charts/climate>



Kick-off meeting

WP 11 CLIMATE TASKS

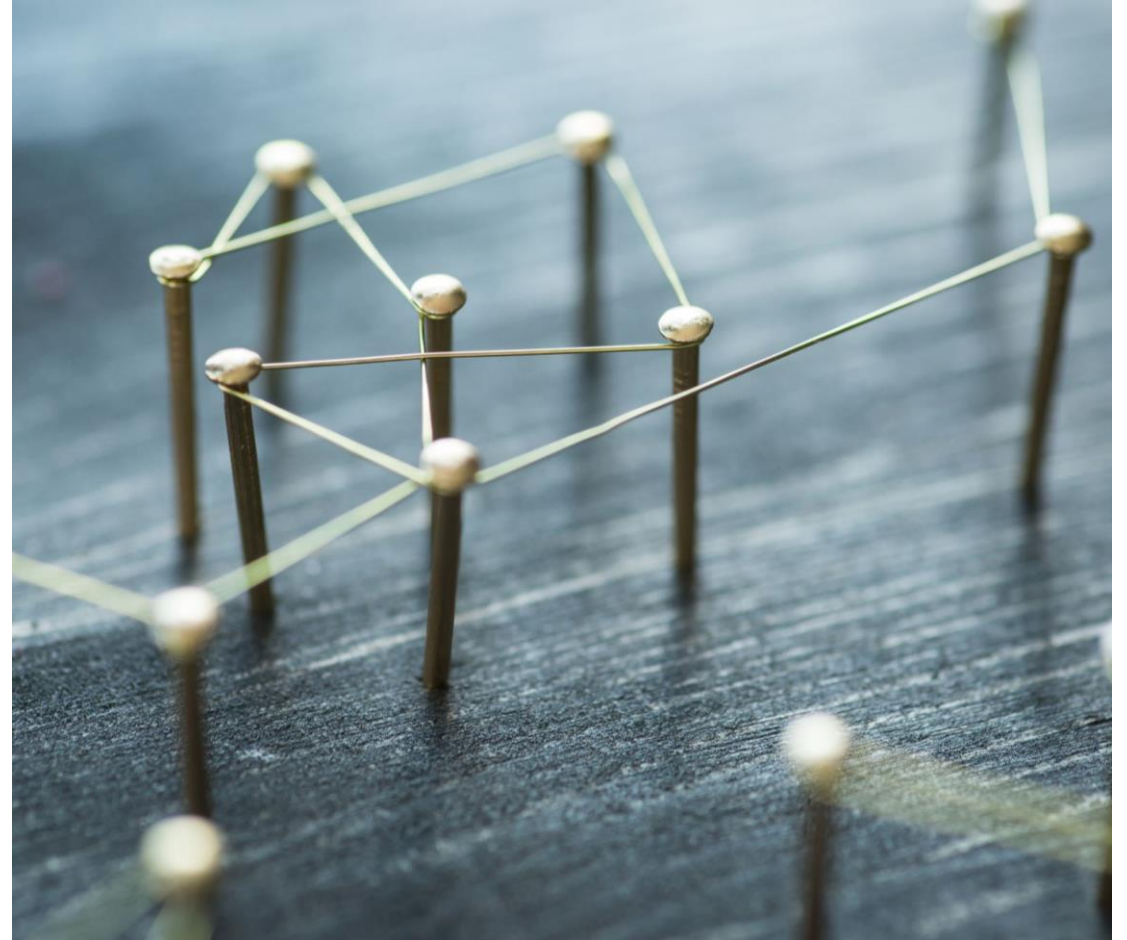


WP11 TASK 1: MANAGEMENT / COORDINATION OF THE WP

Partners BGE, NTW, SKC CEN, VTT

Leader AMPHOS21

The main goals of Task 1 are the overall **management of the WP** including scientific-technical coordination, monitoring and reviewing the WP progress and outputs against the work plan and dissemination / outreach of the results.



WP11 TASK 1 SUBTASKS

Subtask 1.1 Coordination

- WP Board (composed of Task Leaders) meets monthly and ensures progress as per planning, milestones, and deliverables;
- Task 1 Leader communicates with other WPs and reports work progress, deliverables, and modifications to PMO.

Subtask 1.2 Dissemination

- Organises annual WP meetings;
- Organizes Task 1 technical meetings;
- Contributes to EURAD-2 newsletters and website (bi-annual updates) and WP11 deliverables.

Subtask 1.3 Quality Control

- Reviews milestones, deliverables, and KPI targets;
- Ensures alignment with Grant Agreement;
- Data management: Project Place WP11 workspace.

WP11 TASK 2: KNOWLEDGE MANAGEMENT

Partners AMPHOS21, EIMV, ENEA, GTK, IRSN, SSTC NRS, SÚRAO, TUS

Leader BGE

The main goal of Task 2 is to capture knowledge relevant to the SRA topic of this WP and to contribute to **knowledge transfer** to the EURAD-2 community and beyond through the EURAD-2 KM programme.

Task 2 Leader will organise **cooperation between the WP** and all relevant parties involved in KM activities in EURAD-2.

WP11 TASK 2 SUBTASKS

Subtask 2.1: Knowledge capture

- Goal: The objective of this task is to capture knowledge relevant to the WP, gained before EURAD-2 and extended during this WP progress.
- Deliverable: D11.1 White Paper on climate change impacts on nuclear waste management facilities (M18 – 03/2026)
 - climate change impacts on nuclear waste management facilities and sites across climate zones in Europe and during both the short-term (construction, operation) and long-term (post-closure).
 - set of recommendations and proposals for actions to address the identified gaps in data management, protocols, methodologies, and practices for a robust climate risk assessment.
- Linked to WP2 KM Task 2

WP11 TASK 2 SUBTASKS

Subtask 2.2: Knowledge transfer

- In close cooperation with KM WP, specific activities to transfer knowledge on topics addressed by WP11 Climate, will be delivered, building upon the expertise of the different partners involved in this subtask
- Milestones: Two online training courses (one day each)
 - MS44 Online user-driven training course (M11 – 08/2025) on fundamentals of climate change, impacts of climate change on radioactive waste facilities, and climate risk assessment within this context
 - MS78 Online training course (M20 – 05/2026) on modelling methodologies directed toward radioactive waste and climate change experts
- Linked to WP2 KM Task 4

WP11 TASK 3: CONSTRUCTION AND OPERATIONAL PHASES CLIMATE IMPACTS

Partners ANDRA, AMPHOS21, BGE, BGRM, EIMV, ENEA, GI-BAS, GRS, IRSN, MITTA, SCK CEN, SSTC NRS, SÚRAO, TUL, TUS

Leader VTT

The objective of Task 3 is to **identify knowledge gaps** and **provide recommendations** for future research needs on the **impact of climate change** on **radioactive waste management facilities** (predisposal, surface, shallow, near-surface and deep geological facilities for LLW, LILW and HLW) **during construction and operational phases.**

The secondary objective of Task 3 is the interaction with stakeholders (including civil society) on the findings in Task 3.

WP11 TASK 3 SUBTASKS

Subtask 3.1: Regulatory and institutional framework

- The current international, European, and national regulatory and institutional frameworks on climate change impacts on radioactive waste management facilities and sites during the construction and operational phases are collected, and the gaps and needs are identified for draft deliverables D11.1 and D11.2.

Subtask 3.2: Assessment of climate scenarios, sites, and natural analogues

- Climate change scenarios, radioactive waste management facilities and sites, climate change related natural analogues, and climate hazard evolution are assessed across climate zones in Europe during the construction and operational phases for draft deliverables D11.1 and D11.2.

Subtask 3.3: Methodologies for risk assessment

- Climate hazard screening, identification and scoring methodologies, as well as climate modelling and risk assessment methodologies for construction and operational phases are collected and assessed for draft deliverables D11.1 and D11.2.

WP11 TASK 4: POST-CLOSURE PHASE CLIMATE IMPACTS

Partners ANDRA, AMPHOS21, BGE, BGRM, ENEA, FTMC, GI-BAS, GRS, GTK, IRSN, MINEA PARIS, MITTA, SSTC NRS, SÚRAO, TUL, TUS, TY, VTT

Leader SCK CEN

The objective of Task 4 is to identify **knowledge gaps** and provide **recommendations** for future research needs on the **impact of climate change** on **radioactive waste management facilities** (shallow, surface, near-surface and deep geological facilities for LLW, LILW, and HLW) **during the post-closure phase.**

The secondary objective of Task 4 is to interact with stakeholders (including civil society) on the findings in Task 4.

WP11 TASK 4 SUBTASKS

Subtask 4.1: Regulatory and institutional framework

- Collect the current international, European, and national regulatory and institutional framework on climate change impacts on radioactive waste disposal sites during the post-closure phase
- Partners will identify gaps and needs and will provide recommendations for its future development within the European framework

WP11 TASK 4 SUBTASKS

Subtask 4.2: Assessment of climate scenarios, sites, and natural analogues

- Assess climate scenarios in different climate zones over Europe during the post-closure phase
- Select, profile and compare representative radioactive waste disposal sites (surface, near surface and deep underground) in different climate zones across Europe, and identify data needs and constraints – this includes a short site characterisation description
- Collect natural analogues relevant for the selected sites in different climate zones (similar bioclimatic geographical area, bedrock, soil types, geo- and hydromorphological characteristics etc.)
- Assess climate change risks related to the different climate change scenarios and facilities/sites across Europe

WP11 TASK 4 SUBTASKS

Subtask 4.3: Methodologies for risk assessment

- Evaluate scenario formulation methodologies with respect to climate change
- Collect and assess climate modelling (including environmental modelling) and risk assessment methodologies for the post-closure phase
- Identify needs and gaps for the selected post-closure phase case studies, including using natural analogues

WP11 TASK 5: INTERACTION WITH CIVIL SOCIETY

Partners AMPHOS21, BGE, ENEA, IRSN, SSTC NRS, TUS, VTT

Leader NTW

The main goal of Task 5 is to **coordinate the interaction with Civil Society experts** (also possibly outside the nuclear field) on socio-technical challenges and associated uncertainties, identify **stakeholder views** related to the impacts of climate change on nuclear waste management, foster an efficient collaboration between WP partners, and develop recommendations for transparent information exchange and dialogue with civil society.

WP11 TASK 5 SUBTASKS

Subtask 5.1: Coordination of Interactions with Civil Society

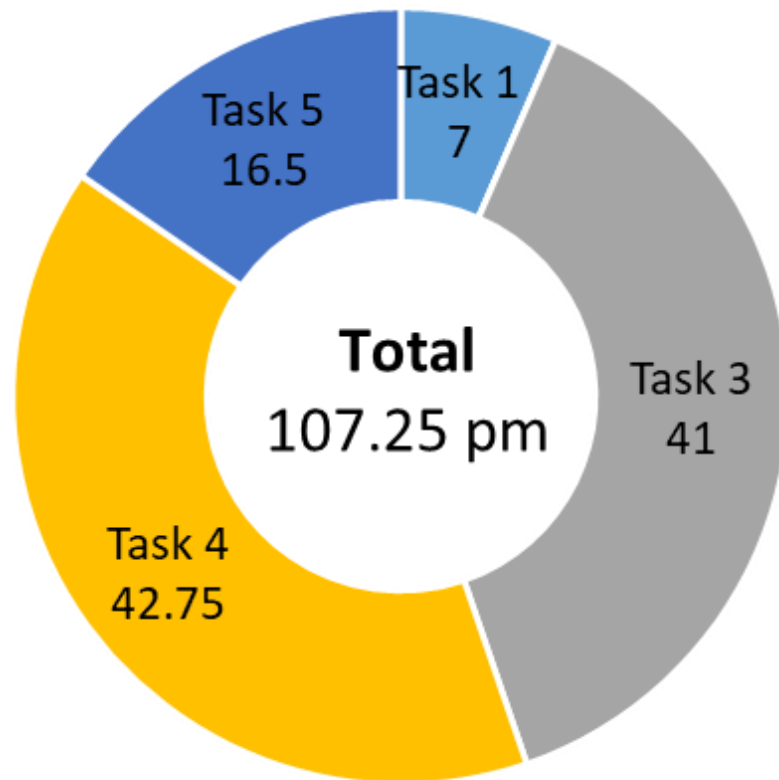
- Link between CS experts and Tasks 3 & 4
- This subtasks aims at organizing the interactions between dedicated CS experts and technical partners from tasks 3 and 4, thanks to technical partners present in task 5
- Through working meetings, the main aim is to gather views from all kind of actors involved (3 colleges and CS) about socio-technical challenges and associated uncertainties in Tasks 3 and 4

Subtask 5.2: Interactions and dissemination activities with Civil Society

- Links with CS experts and CS Larger Group members
- This subtask aims at organizing the two annual 3+1 (TSOs, REs, WMOs + Civil Society) workshops
- Relying on the different views, socio-technical challenges and uncertainties identified by subtask 5.1, the objectives of the workshops are:
 - Workshop 1: Confront views and establish a shared position about climate change impact on RWM
 - Workshop 2: Develop common recommendations about how to tackle the challenging uncertainties

WP 11 CLIMATE FUNDED PARTNERS BUDGET DISTRIBUTION

WP11 CLIMATE

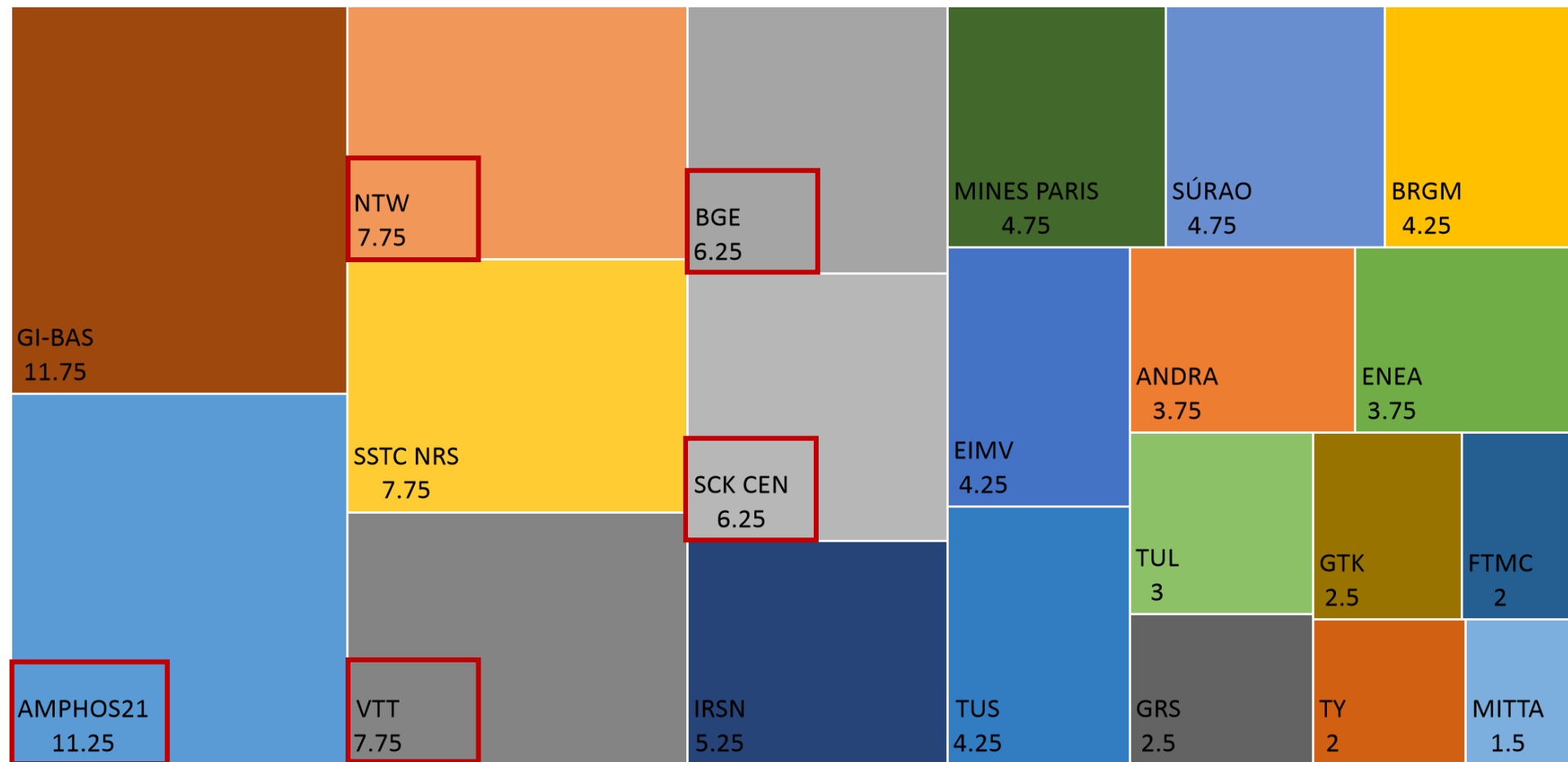


Task 2 Budget

- It is included within WP2 Knowledge Management

WP 11 CLIMATE FUNDED PARTNERS BUDGET DISTRIBUTION

WP11 budget per funded partner



Task leaders, composing the **WP11 Board**

WP 11 CLIMATE DELIVERABLES AND MILESTONES

Item	Title	Lead	Project month	Deadline
MS8	Kick-off meeting	AMPHOS21	M3	12/2024
MS17	WP Workshop 1	NTW	M5	02/2025
MS43	WP Annual Meeting 1	VTT	M11	08/2025
MS44	Online user-driven training course	BGE	M11	08/2025
MS66	WP Online Workshop 2	NTW	M16	01/2026
D11.1	White paper	BGE	M18	03/2026
D11.2	Synthesis report	AMPHOS21	M18	03/2026
MS78	Online training for radioactive waste and climate experts	BGE	M20	05/2026
MS82	WP Annual Meeting 2	SCK CEN	M22	06/2026

Training course
(Task 2)

WP11 meetings

Workshops
(Task 5)

Deliverables

24-10-2024

Kick-off meeting

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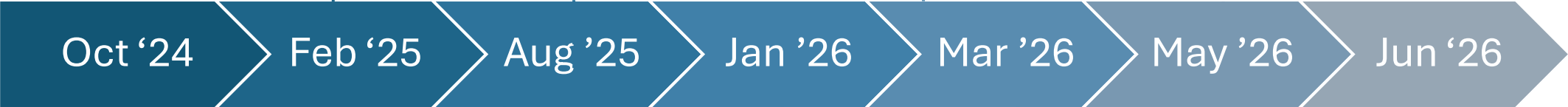
WP 11 CLIMATE DELIVERABLES AND MILESTONES

Online training for radioactive waste and climate experts

WP Workshop 1

Synthesis report

WP Annual Meeting



Training course

WP11 meetings

Workshops

Deliverables

Oct '24

Feb '25

Aug '25

Jan '26

Mar '26

May '26

Jun '26

Kick-off meeting

Online user-driven training course

WP Workshop 2

White paper

WP Annual Meeting

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WP11 CLIMATE KEY LINKS

WP	Collaboration
WP3 ASTRA	Collaborate on the topic of climate change impacts on RW long term storage and deep boreholes disposal.
	Inputs from WP11 to WP14 on the effect and impact of climate change on the factors that control different combinations of layers in the multilayer cover structure (water and energy flows, erosion, ...)
WP 14 SUDOKU	Inputs from WP14 to WP11: composition of multilayer cover used in different surface disposal facilities (in operation or planned to be in operation in near future). A joint workshop on the common topics for WP14 and WP 16 will be organized.

WP11 CLIMATE RISKS & MITIGATION

Risk	Proposed mitigation measures
Data availability (e.g. data for radioactive waste facility profiling for climate risk assessment incomplete or without clearance to be released)	<ul style="list-style-type: none"> • Consultation with external experts and consultation of scientific sources to build model case studies based on informed assumptions.
Difficulties in the integration of data from different climate regions and from different types of radioactive waste facilities	<ul style="list-style-type: none"> • Detailed analysis of the data procured by partners. • Consulting with national and international meteorological and radioactive waste organizations. • Partner brainstorming at task level concerning the accuracy of the data.
Difficulty in developing a representative scope for the European region	<ul style="list-style-type: none"> • Regular assessment of the balance between country/radioactive waste site/climate representativeness in task development and outcomes.
Lack of balanced information collection and sharing amongst consortium partners	<ul style="list-style-type: none"> • Appropriate communication between consortium partners. Promotion of the project plan. WP partner meetings and consultation.
Lack of interest from stakeholders in the WP	<ul style="list-style-type: none"> • Implementation of high-quality promotion plan of the WP. • Activities focused on appropriate communication with stakeholders. • Engagement in workshops.
Temporary unavailability of consortium partners to provide requested information	<ul style="list-style-type: none"> • Overlapping of competencies guaranteed to allow for the exchange of service provision amongst consortium partners. • Suitable distribution of tasks amongst consortium partners.

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