European Joint Programme on Radioactive Waste Management and Disposal

Influence of temperature on clay-based material behaviour
Work Package description

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Main objectives of the Temperature WP

- The first objective is to *apply existing* and *produce new* knowledge about the behaviour of clay materials at elevated temperatures.
- The second objective is to investigate
  - transport, mechanical behaviour and mineralogy at high temperature
  - both by modelling and experimental work
  - in host clay rock formations and bentonite buffer.
- The third objective (different for clay rock and bentonite buffer)
  - host clays formations: aim is to deploy knowledge to mechanics of clay in order to better evaluate and model possible damage evolution during the temperature transient phase, and better assess the consequences of a possible damage
  - Bentonite buffer: aim is not only to deploy knowledge to chemical, mechanical and transport changes of bentonite, but also study how bentonite affects on surrounding bedrock, and canister corrosion
- The fourth objective is include all the above to Safety Cases studies

WP contribution to the SRA sub-domains and priorities

- WP will create a excellent scientific and very important technical contribution about clays at higher temperatures:
  - Clay host rock below 120 °C and
  - Bentonite buffer over 100 °C but under 150 °C .

The temperature evolution and potential damage induced during the temperature transient phase are one the most important factors in design of the final disposal repository for HLW and spent nuclear fuel.

WP Contribution cont.

- 1.4 Near-field and Engineered Barrier System - 1.4.1 Bentonite and Other Clay Based Components:
  - Not enough research has been carried out at high temperatures
  - The temperature limit is being reconsidered as optimisation of design progresses. Accepting that higher temperatures will be economically beneficial this knowledge gap needs to filled.
  - Therefore, the work package will give an important contribution by extending the clay understanding to elevated temperatures.

Expected impacts

WP has three targets:

1. High temperature effects on clay-based materials (safety)
2. Fracturing under thermal loading (safety)
3. Design optimization (costs)

- The first impact is to allow the usage of higher temperatures in repositories leading to decreasing disposal costs while maintaining safety (costs)
- The second impact is knowledge about *how high* temperatures can be used, their limits and which kind of overall impacts higher temperatures causes to materials and system (safety)
- Third, the WP produces data for Safety Case studies (safety).
- Fourth, the WP advances safety disposal of spent fuel, and makes it easier to communicate with the society about these type design changes, and enhances knowledge transfer. (safety)

Work Package
Influence of temperature on clay-based material behaviour

*DRAFT 1– TO BE REVISED BASED ON **WMO, TSO** AND RE DISCUSSIONS*

Note – TASKS 2 and 3 both include experimental and modelling issues, integrated

Task 1: Common basis
Task 1.1: Existing data – State of the art documenting
Task 1.2: Differences in clay host rock and clay buffer

Task 2: Clay host rock <120°C
Task 2.1: Near field with EDZ
Task 2.2: Far field -over pressure driving damage

Task 3: Clay buffers >100°C
Task 3.1: Changes in mechanical behaviour - drying and rewetting
Task 3.3: Chemical and mineralogical changes
Task 3.4: Effects on rock and canister

Task 4: THMC modelling
Task 4.1: Tool development and data collection
Task 4.2: Model benchmark testing
Task 4.3: Application of models

Task 5: Impacts and deployment of results
Task 5.1: Integration of results
Task 5.2: Safety Case
Task 5.3: Knowledge transfer
Task 5.3: Conclusion and reporting

Time schedule

- 15 Dec. 2017 Updated RDD/Networking/KM WP descriptions
- End of December Deadline for Ministries to mandate Beneficiaries
- January 2018 First internal Review
- February 2018 EJP1 meeting n°2 (tbd)
- April 2018 Updated RDD/Networking/KM WP descriptions
- May 2018 Second internal Review
- End of May 2018 EJP1 meeting n°3 (tbd)
- June 2018 Stabilisation of the technical content for the proposal
- June – Sept. 2018 Finalisation of the administrative, financial and legal aspects, editorial work
- Sept. 2018 Submission of the EJP proposal to EC

Participants

- 29 participants
- 7 WMO, 19 RE, 2 TSO, 1 RE/TSO)

WMO

ANDRA
BGE
DBE
Enresa
Nagra
Posiva
RWM

TSO

GRS
IRSN

TSO/RE

VTT

RE

BGR
BGS
BRGM
CEA-SACLAY
CNRS GeoRessources
CNRS Lyon
CTU
EDF
GTK
HZDR
IEG NASU
LEI
PSI
RATEN ICN
UJV
CIEMAT
ULG
UNI-Pannon
University of Helsinki

Costs and financing

- Type of eligible costs:
  - Direct Personnel costs (unit or actual costs)
    - Other Direct costs: Travel
    - Equipment
    - Costs of large research infrastructure
    - Other goods and services
  - Indirect costs (flat rate: 25% of direct costs)
  - Costs for subcontracting
- Financing:
  - RD&D 17.1M€ EC funding for 7 WPs
  - About 2.5M€ per WP
  - Total financing about 5M€ per WP (can be less or bit higher depending on the content of WP)
  - Joinf Funding means (and that is new compared to earlier Euratom projects)
    - 50% of eligible costs to be covered by EC **(New!)**
    - 50% of eligible cost by some other funding source **(New!)**
    - Eligible costs may not cover all costs of every participant – similar to many other recent projects