A0015

DOPAS

TRANSLATING THE EXPERIENCE FROM FULL-SCALE PLUGS AND SEALS EXPERIMENTS INTO A COMPREHENSIVE DOPAS TRAINING WORKSHOP (TWS)

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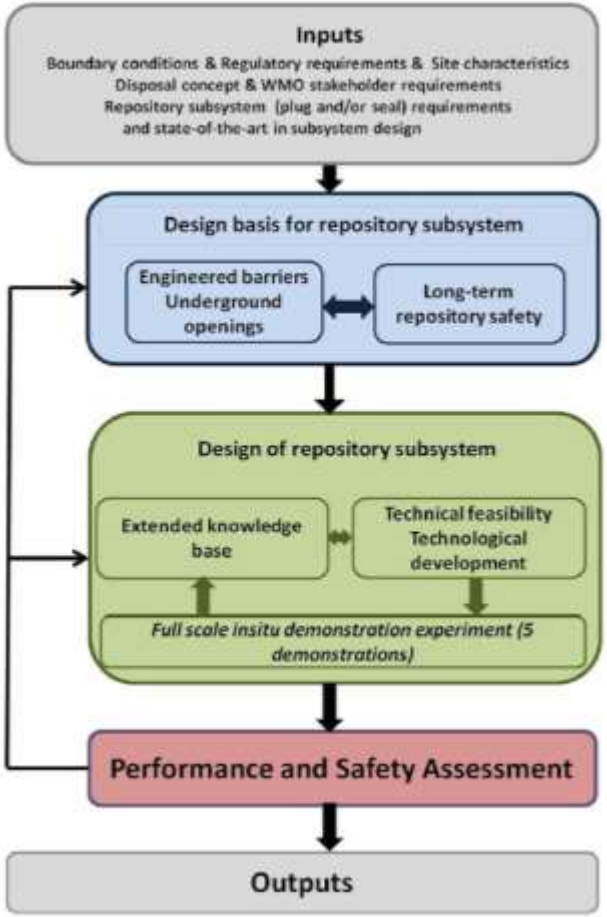
About the DOPAS project

www.posiva.fi/en/dopas

DOPAS (2012-2016) in general
Full-scale demonstration of plugs and seals

- **DOPAS is about full-scale demonstrations of plugs in underground and above ground with 4 year duration**
  - **for the feasibility of construction and for the performance assessment of the plugs selected for the demonstrations**

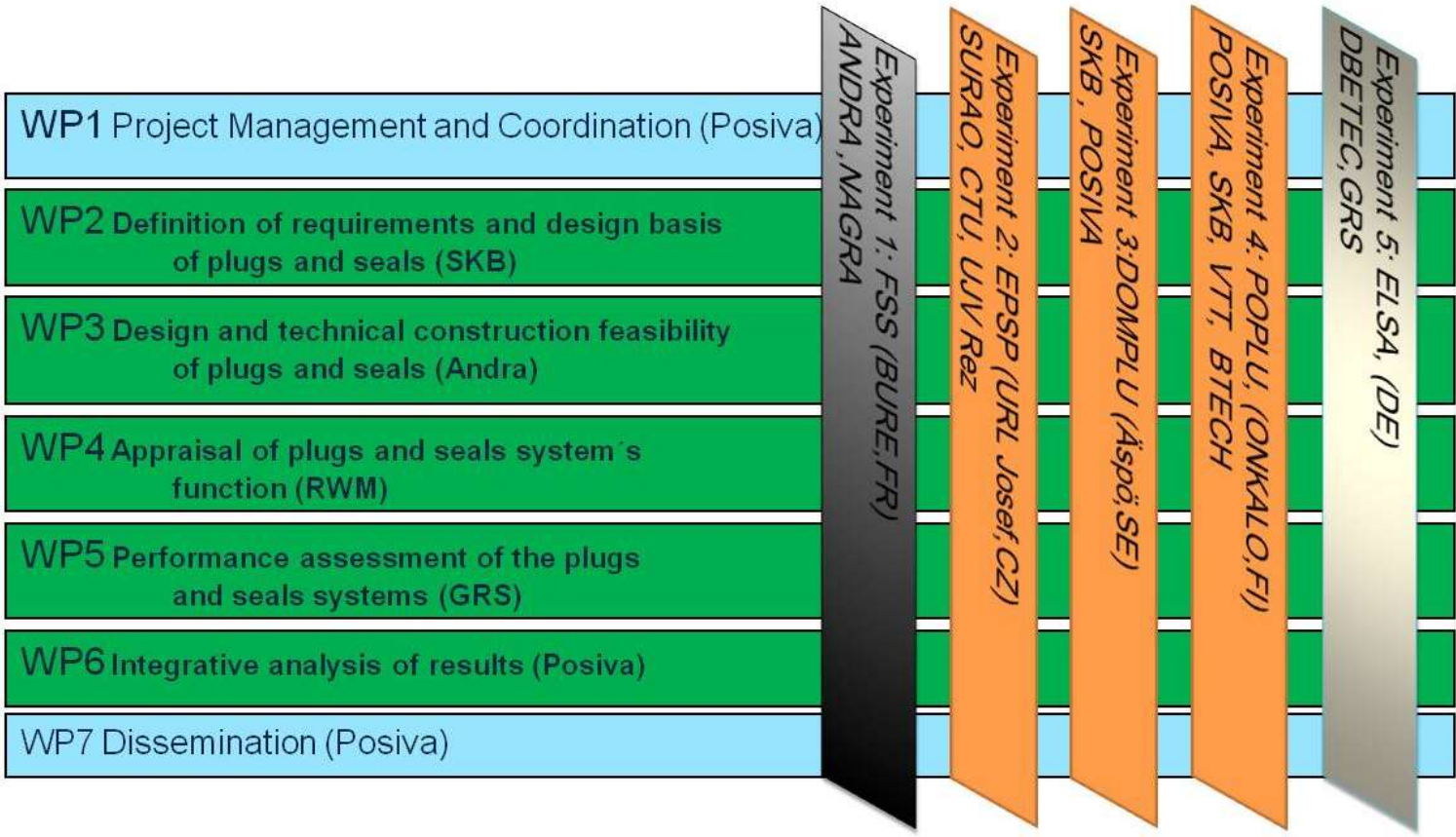
  and preparatory work for full-scale shaft sealing
- **14 partners, 8 countries, 5 experiments**
- **15.8 million euro budget with Euratom FP7 support**



Seven DOPAS work packages and five experiments are

implemented partly or fully in underground or above ground conditions.

Results can be used for planning of L/ILW and Spent Nuclear Fuel repositories.



The training workshop is a part of the WP7 Dissemination.

Examples of the experiments are presented in the following.

1. FSS (Andra & Nagra)

- FSS installing and emplacement actions done by September 2014, seal intended for clay.
- Clever dismantling finished at end of August 2015.

Photos © ANDRA

2. EPSP (SURAO, CTU & UJV Rez)

- Plug location host rock improvement was done during 2014
- Construction of plug elements (e.g. shotcreting) started in Autumn 2014
- Bentonite saturation on-going in August-September 2015

Crystalline host rock of Josef Underground Laboratory

Photos© SURAO & CTU & Marjatta Palmu

3. DOMPLU (SKB & Posiva)

Current reference design for KBS-3V repositories in Sweden and Finland.

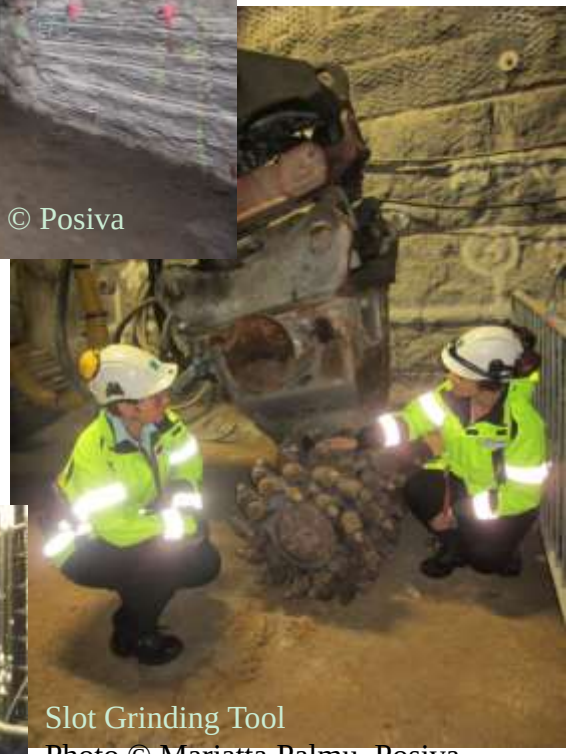
- Wire sawed plug slot was produced in crystalline rock
- Dome plug was cast in March 2013 and a cooling system installed (outside the scope of DOPAS)
- DOPAS reporting done and experienced used in DOPAS
- Plug's performance is currently monitored

Photos: SKB

4. POPLU (Posiva, SKB, VTT & B+TECH)

- Plug location selection using repository criteria
- Slot excavation produced with boring, wedging and grinding method
- Plug installing and emplacement activities in 2015
- Plug was reinforced, instrumented and cast in two parts
- Pressurisation of the plug is on-going

POPLU Slot location. Photo © Posiva

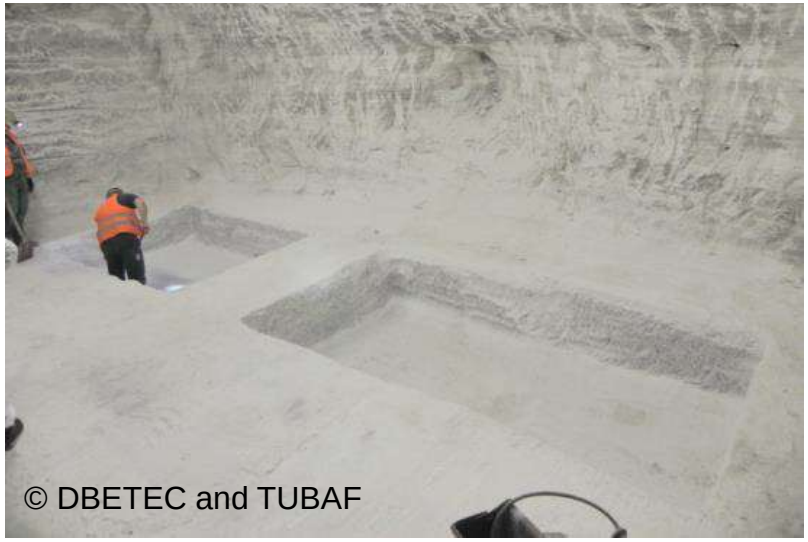


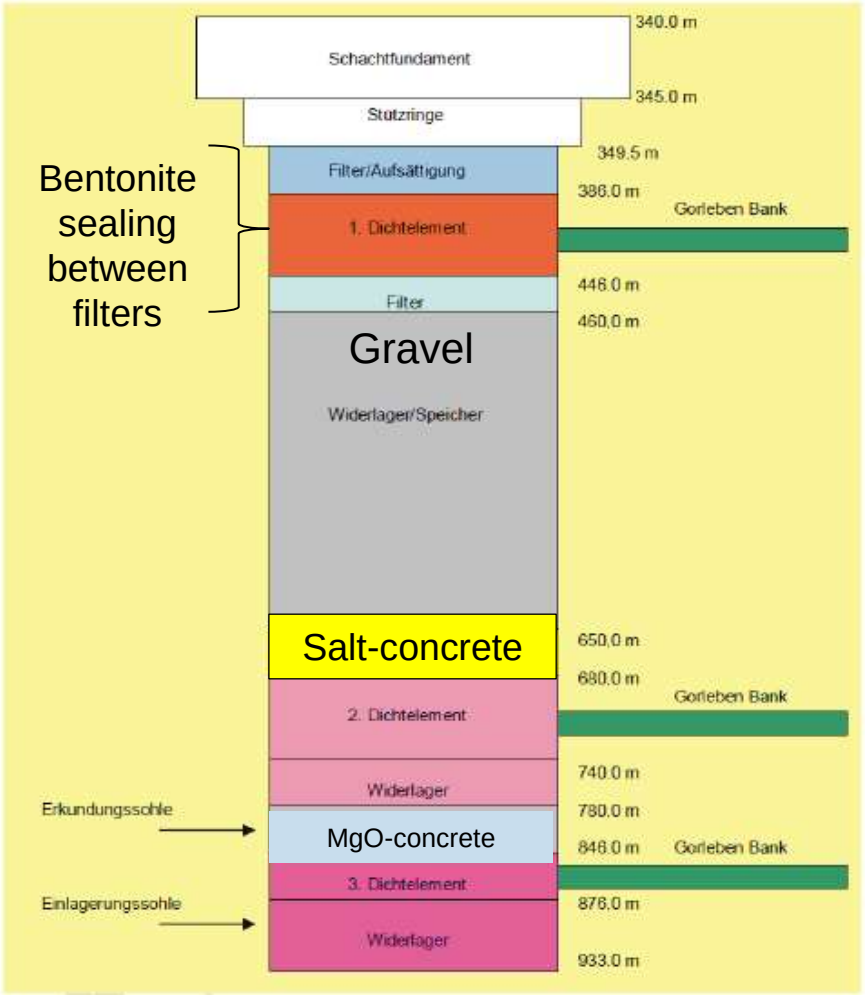
Slot Grinding Tool
Photo © Marjatta Palmu, Posiva

Staff exchange 2015
Photo © Posiva /Petri Koho

5. ELSA shaft seal experiment in Germany GRS+DBETEC and BMWi)

ELSA related background laboratory and modelling work for LAVA, LASA and THM ton on-going preparing for a future full-scale sealing demonstration. Gorleben shaft depth is over 900m. Foreseen seal lifetime couple of hundred thousands years.





Source: DBETEC

DOPAS Training Workshop (TWS) – Key ideas? Hopefully not:

Following photos © Marjatta Palmu unless otherwise stated

DOPAS TWS - Key planning ideas

- **Translating the project experiences into professionals' training**
- **Key underlying ideas in the planning process**
  - **Implementing a full learning cycle**
    - **starting from expectations, experience and orientation including, planning and abstraction with activities for the next loop of the learning cycle**
  - **Benchmarking the progress of other experiments against one more detailed experiment case**
  - **Grasping the concept of time more concretely**
  - **Contrasting the different work environments and the role of the experiments in the whole RD&D process**
  - **Team building and network creation**




Photos © Marjatta Palmu

DOPAS Training Workshop planning team

- **Training planning coordination and leaderships: Posiva & CTU**
- **Trainers – experiment leaders and Czech project partners**
- **Andra, France, SKB, Sweden, Posiva, Finland, CTU, SURAO and UJV Rez a.s, Czech Republic, GRS, Germany, RWM, GB**
- **Training locations: University, underground laboratory and two research centres (Josef and UJV Rez)**

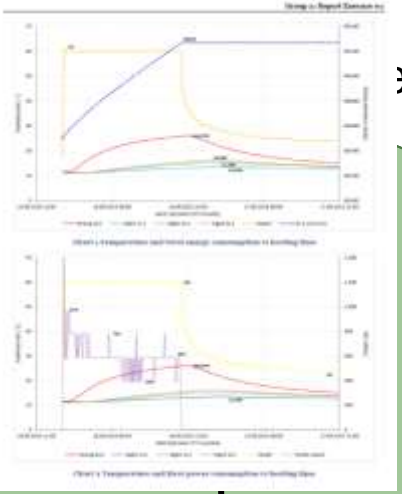
Planning group member	**Organisation, country**
Marjatta Palmu, task leader of the training workshop, WP6 leader of DOPAS	Posiva Oy, Finland
Radek Vašíček, DOPAS training workshop course leader	CTU, Czech Republic
Jacques Wendling, Performance assessment of Andra's programme	Andra, France
Régis Foin, FSS experiment leader	Andra, France
Jiri Svoboda, EPSP experiment leader	CTU, Czech Republic
Pär Grahm, DOMPLU experiment leader	SKB, Sweden
Petri Koho, POPLU experiment leader	Posiva Oy, Finland
Lucie Bělíčková, Prague and Rez organization	SURAO, Czech Republic
André Rübel, Safety and performance assessment, WP5 leader of DOPAS	GRS, Germany
Dean Gentles, Application of lessons to other waste management programmes, WP4 leader of DOPAS	RWM, Great Britain

Learning Outcomes (LOs) envisaged

- **To understand** (KNOWLEDGE) **the process/es of designing a full-scale experiment** from a set of requirements related to the performance of the safety function/s of a plug or a seal as a repository component in geological disposal.
- **To be able to contrast** (SKILLS) **the differences of such processes resulting from the different boundary conditions** e.g. from the host rock environments (clay, crystalline rock, and salt), the experimental settings (above ground, underground experimental facilities vs. real repository conditions) and other site and disposal concept specific features.
- **To comprehend** (KNOWLEDGE) **the linking of different experiment project's subprojects and tasks**, **and their inputs and outputs** as a part of the experiment implementation.
- **To acquire hands-on experiences in experimenting** with materials' testing and monitoring techniques (SKILLS) needed in an experiment, and
- **To know how the individual experiments and their outputs contribute** to the overall demonstration and demonstration programmes for safety of the waste management programmes (KNOWLEDGE) at the different stages of repository development.

Kolb's experiential learning cycle

Adopted from Kolb (1984)



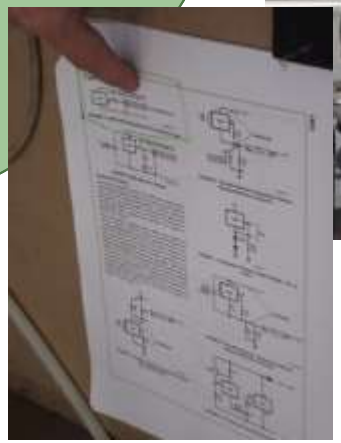
Experimentation (Doing)

Knowledge processing

Reflection (Observation)

acquisition

heory (Abstraction)



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Implementation
Five long days in September 2015

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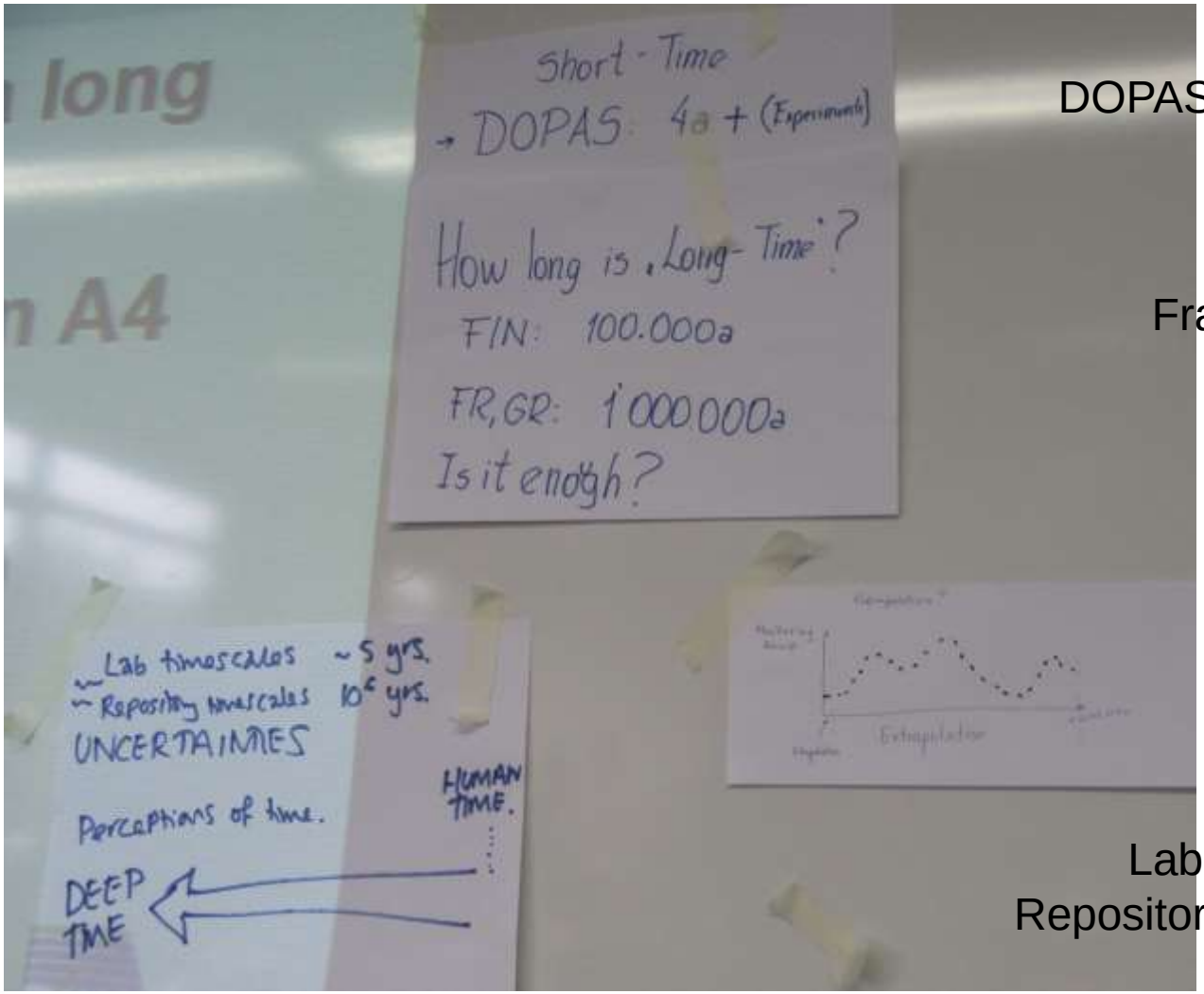
Views on the concept of time by the participants



Short time:
DOPAS 4 years + experiments

How long is ”long time”
Finland: 100 000 yrs
France; GD 1 000 000 yrs
Is this enough?
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Laboratory scales ~5 years
Repository timescales 10^6 years
UNCERTAINTIES
Perceptions of time

DEEP TIME ← HUMAN TIME

Past, present and future as presented by a safety assessment expert

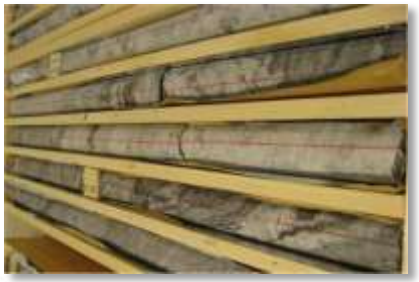
Climate

Durability of constructions

Geology

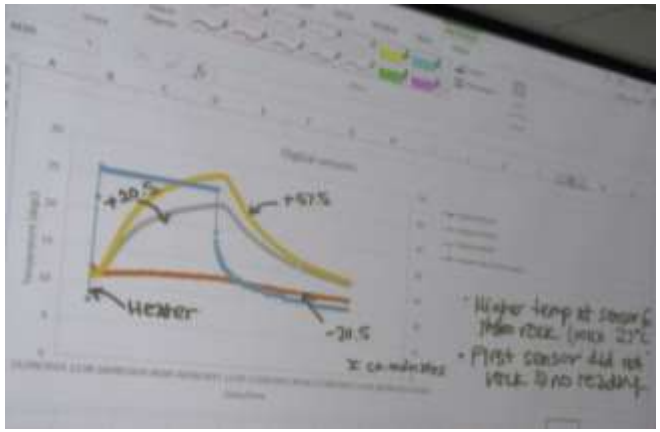
Human behaviour

1 000 000 a | 100 000 a | 10 000 a | 1 000 a | 100 a | present



DOPAS TWS – Implementation: Learning Units (1)

- **Learning Unit 1: From requirements to the design basis of plugs and seals (including project planning for experiments)**
  - **the benchmark example case: DOMPLU (crystalline rock)**
- **Learning Unit 2: Preparation of an in-situ or full-scale plug or sealing experiment (theory and practice)**
  - **the benchmark example case: Andra's FSS experiment aligned with RD&D programme and safe assessment process**
  - **the benchmark case for the role of monitoring of an experiment: EPSP**



DOPAS TWS – Implementation: Learning Units (2)

- **Learning Unit 3: Design of a seal for an experiment/ demonstrator within the broader context of RD&D programmes**
  - **the state of the art of the RD&D programmes in France and Nordic countries**
  - **behaviour of materials and components: case laboratory testing in the Czech experiment (UJV ReZ)**

  - **introduction to safety assessment (SA) and role of safety case**
  - **benchmark case: ELSA, Germany –integration of the experimental work and process modelling to SA/safety case**
  - **benchmark case: Exercise in Josef: monitoring for performance assessment of experiment components**

DOPAS TWS – Implementation: Learning Units (3)

- **Learning Unit 4: Construction Feasibility of a plugging experiment**
  - **benchmark cases: DOMPLU and POPLU risk management of large scale underground experiments**
  - **benchmark case: FSS feasibility of a large scale seal for clay environment – including alternative concept development for risk management**
  - **benchmark cases: ELSA and RWM how to apply the lessons learned for the future**
  - **underground and experiment working methods – lessons learned panel**

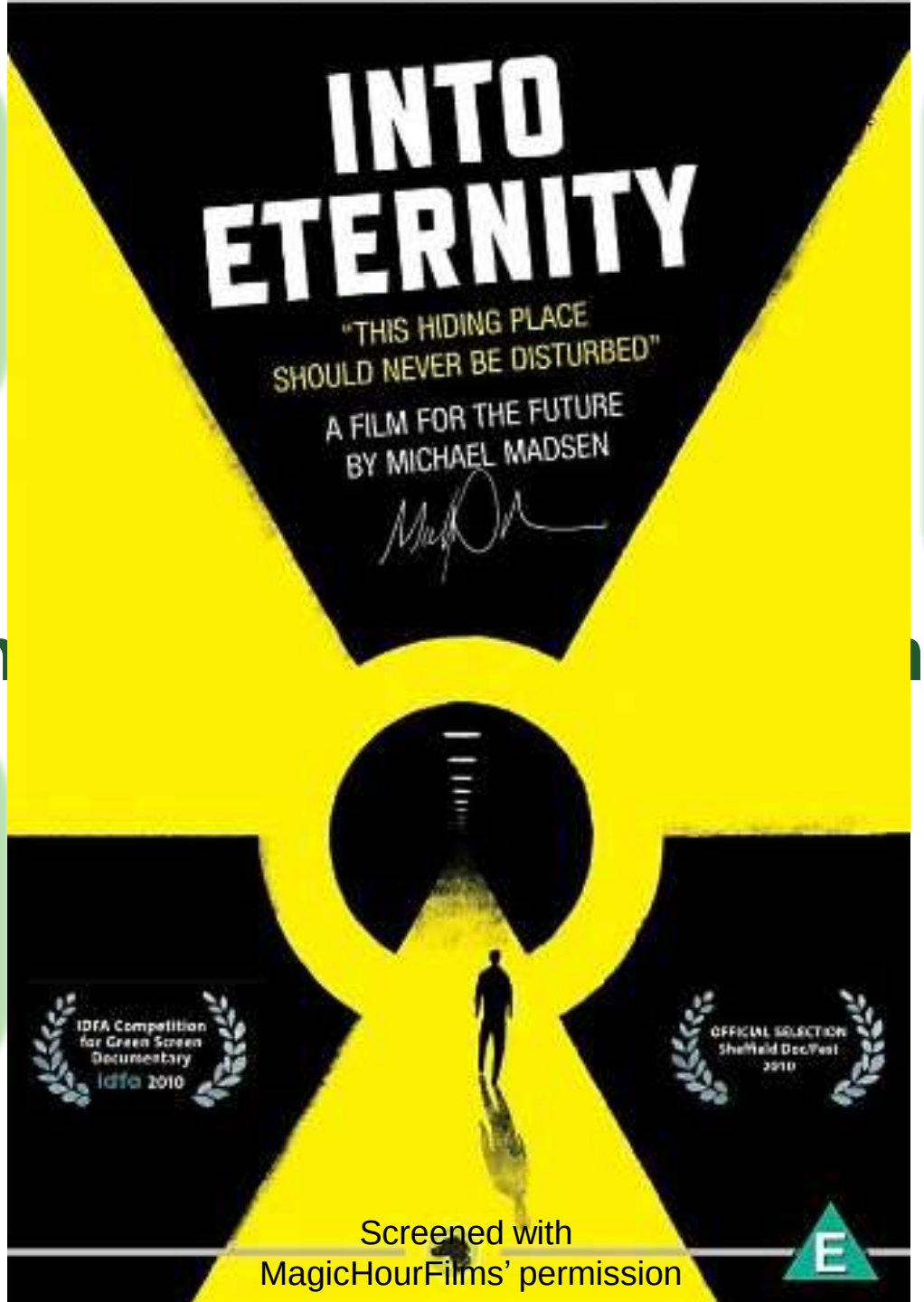
- **Exercise reporting and feedback by all tutors**

DOPAS TWS – Implementation (4)

- **Additional complementary activities:**
  - **Project introduction and introduction to the activities of the tutoring organisations**
  - **Introduction to the Josef Underground Laboratory's activities and geological conditions and visit to the on-going experiments including EPSP experiment**
  - **Picnic at Josef**
  - **Visit and movie night at SURAO's information centre including**
    - **Introduction of SURAO's public involvement and information activities,**
    - **Presentation of the Czech repository siting programme**
    - **Into eternity movie and related discussions**
  - **Benchmark case: ELSA, Germany – introduction and integration of the experimental work and process modelling to SA/safety case**
  - **Visit to the Josef Cathedral and ad hoc dinner in Prague**
  - **Summary, assessment and feedback**
  - **Final Prague sight-seeing tour**

A 76 min documentary by Danish director Michael Madsen

This documentary has received several prices and has been used especially by less advanced programmes for communication



Premiered at DocPoint festival 2010 in Helsinki, Finland

Filmed on site in Olkiluoto, Eurajoki, Helsinki, and Stockholm

Screened with MagicHourFilms' permission

Assessment of and at the DOPAS Training Workshop 2015

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DOPAS Training Workshop

- **Assessment methods used**
  - **ice breaker exercise – setting objectives and helping in team building – benchmark for achievement of objectives**
  - **the group exercises during the week – immediate feedback during exercises, peer feedback, and feedback in connection of presenting the results**
  - **observation of activity, questions asked, and team working**
  - **first impressions collected**
  - **assessment against the original objectives set**
  - **self assessment in connection with the formal feedback forms**
  - **tutors' feedback and self-assessment**
  - **after the workshop feedback given by tutors on exercise reports**

Peer reviews and debates

DOPAS TWS – Immediate feedback

- **Some spontaneous descriptions of the TWS...**

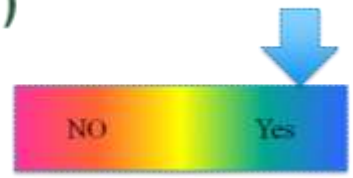
created by Worditout.com

DOPAS TWS – Objectives & Benefits

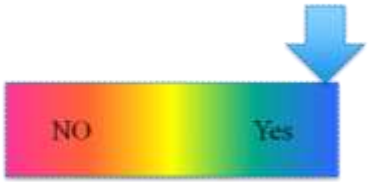
- **Benchmark of achievement of objectives (extract)**

Objectives (1)

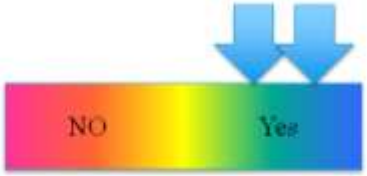
- Input/output for other demonstration experiment



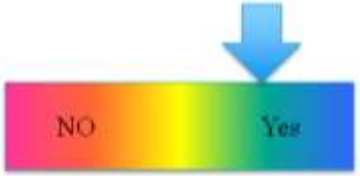
- Understanding the difference and reasons for them



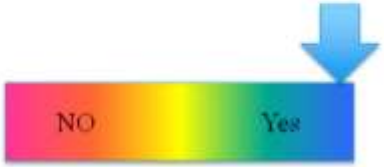
- Geotechnical monitoring



- Short- and long-term monitoring

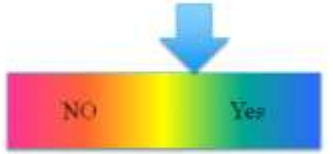


- Hands-on experience



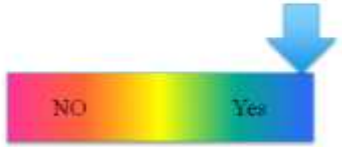
Benefits

- Understanding experiment details, monitoring, instrumentation

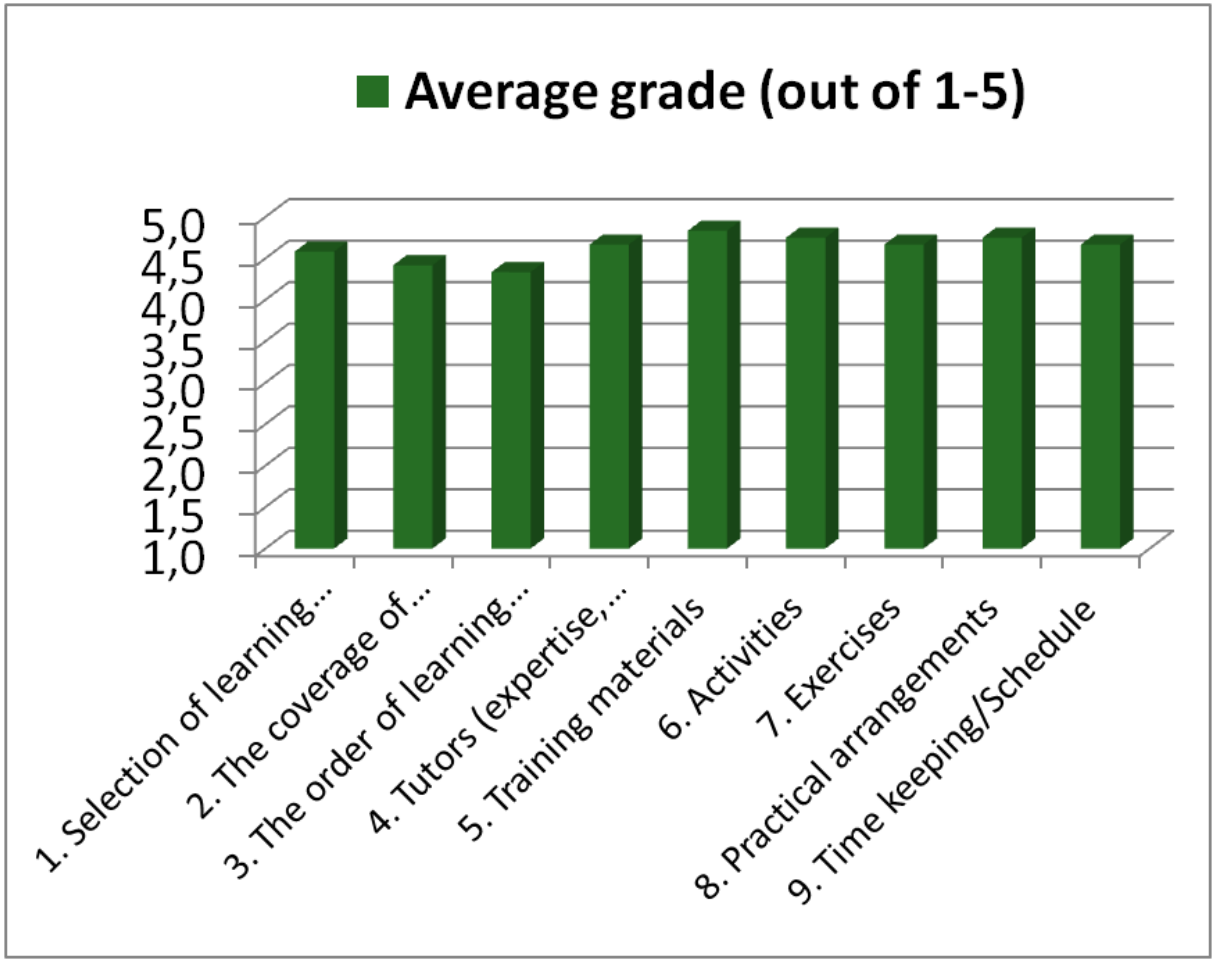


- Share experiences and know-how

- Getting to know people, networking



DOPAS TWS – Formal feedback and assessment



1.-3. of LUs and topics
4. (expertise, tutoring)

- **Grade averages from 4.3-4.8**
- **Tutors' evaluation: much in alignment with the participants' feedback –> a success!**

- **Workload assessed to equal 4 ECTS of academic work**

DOPAS

Thank You!

- D – demonstrative
- O – optimistic
- P – positive
- A – accurate
- S - serious

Photo: CTU/Lucie Hausmannova

The research leading to these results has received funding from the European Atomic Energy Community's (Euratom) Seventh Framework Programme FP7/2007-2013, under Grant Agreement No. 323273 for the DOPAS project.

References

- **For references and abbreviations please visit the conference paper A0015**

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