CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: 5th DECOVALEX-2015 Workshop

DATE/PLACE: April 7–11, 2014
Avignon, France

AUTHOR(S): Goodluck Ofoegbu
Center for Nuclear Waste Regulatory Analyses (CNWRA®)
and
Randall Fedors
U.S. Nuclear Regulatory Commission (NRC)

PERSONS PRESENT: Randall Fedors (NRC) and Goodluck Ofoegbu (CNWRA) participated in the 5th workshop of the DECOVALEX-2015 project.

BACKGROUND AND PURPOSE OF MEETING/TRIP: The workshop was held on April 7–11, 2014 in Avignon, France. The **De**velopment of **Co**upled Models and Their **Val**idation Against **Ex**periments (DECOVALEX) project is an international collaboration focused on modeling thermal-hydrological-mechanical-chemical (THMC) processes associated with the geologic disposal of high-level waste and spent nuclear fuel. The purpose of the workshop was for participants to interact to identify issues and learn from the variety of approaches taken by the different teams. Field trips to the Millau viaduct, Tournemire underground research laboratory, and Roquefort cave were held on the last day and a half of the workshop.

SUMMARY OF ACTIVITIES: The NRC and CNWRA staffs' participation in the 5th DECOVALEX-2015 workshop provided an opportunity to interact and discuss other organizations' approaches and progress in modeling field experiments encompassing near-field coupled THMC processes. The workshop agenda is included as an attachment. The activities at this workshop included (i) discussion on approaches and progress by each participant for the relevant portions of the five tasks, (ii) informal interactions between presentations and group discussions, and (iii) field trips. Discussions of research progress for DECOVALEX-2015 tasks provided a better understanding of the technical difficulties in understanding near-field conditions and the advantages and disadvantages of several alternative approaches.

Involvement with DECOVALEX will allow the staff to leverage expertise from waste disposal programs from many countries in understanding complex near-field processes and issues in a variety of geologic environments. Leveraging international experience will help the NRC staff understand important technical and performance issues that may influence planning and preparation for future regulatory developments as the U.S. national waste policy and program evolve.

The continued development of modeling tools validated against large underground experiments will, in subsequent years, enable staff to provide insights on the importance of coupled processes on repository performance for geologic disposal. The NRC and CNWRA staffs will continue to develop the modeling tools to analyze coupled processes in the near field of repositories in the saturated zone. CNWRA has been tasked to support Task B1. The NRC staff will continue to participate in Tasks A and C1, and all staff will continue to follow discussions for Tasks B2 and C2 to gain insights from the efforts and approaches of other DECOVALEX participants.

Use of these data could guide and constrain scenario modeling of coupled THMC near-field processes when a buffer is present. In addition to the continued development of modeling tools and identification of required constitutive relations for near-field processes, the NRC staff will continue to use information leveraged from international interactions to refine near-field abstraction approaches and data needs for supporting insights into repository performance for a wide range of designs and geologic host media.

Trip Details

Five tasks were agreed upon at the 1st DECOVALEX-2015 workshop in April 2012. CNWRA has been tasked with supporting the NRC team in Task B1. Because of the open and collaborative environment in DECOVALEX, the staff is able to gain insights from the discussions pertaining to the other tasks. Four of the tasks involve modeling of experiments at underground facilities and the fifth task involves modeling of a complex laboratory experiment.

The following tables provide information related to the task description, participants, discussion points, future work, and action items specific to NRC/CNWRA for each task. The acronyms used in the tables for each task are as follows:

BGR	Federal Institute for Geosciences and Natural Resources, Germany
CAS	Chinese Academy of Sciences
CEA	Commissariat à l'Energie Atomique, France
CIMNE	Centre International de Métodes Numèrics en Enginyeria, Barcelona, Spain
CNSC	Canadian Nuclear Safety Commission, Canada
DOE	Department of Energy, USA
ENSI	Swiss Federal Nuclear Safety Inspectorate, Switzerland
IC	Imperial College of London, UK
IRSN	Institut de Radioprotection et de Sûreté Nucléaire, France
JAEA	Japan Atomic Energy Agency
KAERI	Korea Atomic Energy Research Institute, Korea
KINS	Korea Institute of Nuclear Safety
KRMC	Korea Radioactive Waste Management Corporation
KIGAM	Korea Institute of Geoscience and Mineral Resources
KTH	Royal Institute of Technology, Sweden
LBNL	Lawrence Berkeley National Laboratory, USA
NAGRA	Nationale Genossenschaft für die Lagerung radioaktiver Abfälle, Switzerland
NDA	Nuclear Decommissioning Authority, UK
RAWRA	Radioactive Waste Repository Authority, Czech Republic
SNL	Sandia National Laboratories, USA
SNU	Seoul National University
TUL	Technical University of Liberec, Czech Republic
UFZ	Helmholtz Centre for Environmental Research, Germany
UPC	Universitat Politècnica de Catalunya, Spain
UGN	Institute of Geonics, Science Academy of Czech Republic
UoE	University of Edinburgh, UK
Quintessa	Quintessa Ltd., UK

Task A	
Brief Description of the Overall Task	SEALEX experiment at Tournemire underground research facility in France, developed by IRSN. Focus is on hydromechanical performance of bentonite seals for horizontal emplacement boreholes.
Brief Description of the Current Steps, Task A (Completed Steps Are Included. Last Item Listed is the Current Step)	STEP 0—Modeling of bentonite-sand mixture hydromechanical behavior and parameters identification from various laboratory tests such as (i) water retention curves, (ii) infiltration test under constant volume condition, and (iii) swelling and compression tests under suction control condition. STEP 1—Blind prediction of laboratory 1/10th mock-up test using parameters obtained from Step 0. Simplifications used for the mock-up test are the elimination of bentonite-host rock interaction and axisymmetric geometry. The initial gap is employed at start of test. STEP 2—Modeling the hydrological response of the host rock around water injected under a pressure head into a borehole section isolated with a stainless steel packer. STEP 3—Modeling of one of the SEALEX tests, PT-A1. Field scale test of bentonite/sand seal with asymmetrical technological gap and injected water to enhance resaturation rate
Participant/Funding Organization	Software Used for Step 2
RAWRA/UGN	COMSOL
Quintessa/NDA	OpenGeoSys and QPAC
NRC	xFLO-FLAC (temporarily replaced with TOUGH2 for this step)
CNSC/IRSN	COMSOL
IRSN	CODE-BRIGHT
Main Conclusions and Issues	1. Step 0—Compression tests reproduced by all teams, but infiltration test still causes some difficulties; problems with matching the entire suite of curves, which probability illustrates the importance of free swelling and of hydromechanical coupling in general. Curiously, hydrologic-only calibrations fit just as well as the hydromechanical-coupled fits. Mixing of retention curves in the other parts of Step 0 may have caused some problems; mixing of 1.67 and 1.97 g/cm^3 materials. 2. Step 1—Gap and change in boundary condition for the mock-up test are challenging aspects to this problem. Continuous change in properties from initial dry density material (1.97 g/cm^3) to a material comparable to 1.67 g/cm^3 (dry density) as the gap is filled suggests possible approach is to make hydromechanical properties a function of void ratio. A couple issues in results are: • Behavior at 0 (low) suction, gel formation, flooding of gap, and spatial imbibition into sample • Over-prediction of Phase 1 water injected • Difficulty with transition between Phase 2a and 2b

<table>
<tr><th colspan="2">Task A</th></tr>
<tr><td></td><td>3. Step 2—The three most important aspects discussed by teams at the workshop are:

• Location (borehole wall or gallery wall) for the atmospheric boundary condition, and the need to incorporate steady or seasonal fluctuation of temperature and relative humidity at that boundary condition

• Importance of incorporating borehole and/or gallery excavation damage zone in models, and should the properties evolve as rewetting occurs?

• Identify why the change in slope for measured water injection after about 1 day. Is it due to seasonal fluctuation in gallery temperature and relative humidity?

Other potential issues identified by different teams are:

• Is there a need to incorporate micro- macro-porosity model in hydromechanical code?

• How should the initial pore pressure distribution be represented? Inability to reflect pore pressure observations at PT-A1 borehole area (with apparent strong heterogeneity and anisotropy) did not seem to affect estimates of injected water amounts for WT-1 test.

• Does the gallery geometry need to be represented exactly? Also, should the gallery excavation be simulated?

• Is it important to simulate the borehole-flooding phase of the water injection?

• Is it necessary to model in 3D?

• Is it necessary to account for the neighboring gallery?</td></tr>
<tr><td>Future Work</td><td>1. Prepare journal paper on Steps 0 and 1 of this task. The target completion for the paper is end of 2014.

2. Begin modeling for Step 3 test, PT-A1, using properties and modeling approaches determined based on Steps 0, 1, and 2. Additional difficulties expected due to 3D geometry and nonuniform technological void. Groups are encouraged to evaluate axisymmetric and 3D models. Detailed specifications will be issued in mid-May.

3. Groups are to provide information and results for the journal paper. Changes in Step 1 calculation could be requested if judged necessary by the task lead.

4. Task lead will judge whether to request improvements to Step 2 calculations.</td></tr>
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Task A	
Action Items for NRC/CNWRA Staff	When the modeling tool xFlo-FLAC becomes operational, NRC staff can return to Steps 0 and 1 to implement models for infiltration portion of those steps not previously completed, before continuing on to Step 3 (PT-A1 test).

Task B1	
Brief Description of the Overall Task	HE-E experiment run by a consortium of European Union countries at Mont Terri underground research laboratory in Switzerland; focuses on thermal-hydrologic-mechanical performance of two types of bentonite buffers surrounding a horizontally-emplaced analog waste package heated up to 140 °C in a low permeability argillaceous host rock.
Brief Description of the Current Task (Completed Steps Are Included. Last Item Listed is the Current Step)	STEP 1a—Involved modeling the thermal-hydrological-mechanical behavior in Opalinus Clay host rock at another heater test in the Mont Terri tunnel system (i.e., the HE-D test). STEP 1b—Buffer material study: Numerical modeling of CIEMAT column cells with focus on processes understanding and parameter determination. The objective of this step is to calibrate the constitutive relationships for the bentonite pellet mixture based on back analysis of the column tests and literature study. The main parameters are associated with moisture retention curve, dependencies of thermal conductivity and water permeability on degree of saturation, and mechanical constitutive relationships.
Participant/Funding Organization	Software Used
UFZ /BGR	OpenGeoSys
CAS	Elasto-Plastic Cellular Automaton (EPCA) 3D
LBNL/DOE	TOUGH-FLAC
ENSI	OpenGeoSys
CNSC/IRSN	COMSOL
JAEA	THAMES
KAERI	FLAC
CNWRA/NRC	xFlo-FLAC
Summary of Discussion	1. Presentations during the workshop indicate good understanding and agreement regarding the THM processes in the column cell material. 2. However, differences in understanding of the mechanical processes need to be examined further. While several groups believe that mechanical behavior during the heating-only period is dominated by thermal expansion, the CNWRA-NRC model indicates mechanical effects of moisture redistribution during this period are more important than thermal expansion. 3. Also, the second objective of parameter determination through back analysis has not been accomplished satisfactorily. 4. Groups are urged to repeat the analysis with the heater temperature, power input, and heat losses represented correctly and using sensitivity analysis to evaluate key parameters. Only teams that provide the revised analysis will participate in the comparison of calculated results. The parameters to be evaluated are thermal conductivity, permeability, moisture retention, and swelling coefficient.

Task B1	
Future Work	1. Teams to refine column test model calculation and provide results by 5/30/2014, and submit description for interim report by 6/30/2014 2. Provide results of predictive modeling of the HE-E test by at least one week before the 6th workshop (11/10–13/2014) 3. Task Lead will obtain detailed heater-test base geometry and provide to groups by 4/30/2014 4. Task Lead will provide updated column test data to groups by 4/10/2014 5. Task Lead will provide as-built HE-E information to groups by 4/30/2014 6. Task Lead will complete report on HE-D test modeling (Step 1a) by 4/30/2014
Action Items for NRC/CNWRA staff	1. Revise model calculations for the column test and submit results by May 30, 2014. Submit contribution to interim report on column test by June 30, 2014 2. Start work on HE-E test modeling and provide predictive model calculations by 10/31/2014

Task B2	
Brief Description of the Overall Task	“EBS” experiment planned at Horonobe underground facility in Japan; will focus on THMC processes in a bentonite buffer surrounding a vertically-emplaced analog waste package heated to 100 °C in an argillaceous host rock of moderate permeability.
Brief Description of the Current Task	Step 0—Preparation phase. Literature review and analyses of laboratory test data, especially for backfill. Step 1 (revised)—Set up input data for two analyses; one analysis to support sensor layout, and one analysis to predict long-term behavior. Calculated results for Step 1 were compared during this workshop.
Participant/Funding Organization	Software Used
JAEA	Couplys and PHREEQC
BGR	OpenGeoSys coupling with PHREEQC, ChemApp, GEMIPM2K
CAS	Elasto-Plastic Cellular Automaton (EPCA) and TOUGH2
LBNL/DOE	TOUGH-FLAC and ROCMASS (complementary software for confidence building)
KAERI	TOUGH2-FLAC3D
Summary of Discussion	1. Hydraulic parameters (especially, unsaturated property) affect the distribution of water content (saturation behavior). 2. Water content (saturation) gradient develops variation of thermal conductivity. 3. The parameter for the vapor movement due to thermal gradient is very important. Evaluation of this parameter will be discussed further.
Future Work	1. Step 2—Prediction analysis for design of the sensors layout in the buffer material. 2. Step 3—Comparison between monitoring data and analytical results.
Action Items for NRC/CNWRA staff	None. NRC is not a participant in this task.

Task C1	
Brief Description of the Overall Task	Investigate and mathematically model coupled THMC processes using data from laboratory experiments on single fractures through a novaculite (dense microcrystalline quartz rock) and a granitic rock. The experiments are described in Yasuhara et al. (2006) and Yasuhara et al. (2011).
Brief Description of the Current Steps	Step 0—Basic benchmarking for novaculite: • Use profilometer data as a representation of the topology of fracture surfaces to guide grid generation or estimation of statistical parameters of aperture distribution. • Use the aperture distribution data from Yasuhara et al. (2006) to reproduce the observed flow rate at the start of the experiment only (stop at 1,292 hours, before flow reversal). • Geochemistry Benchmark Test: Represent stylized batch experiment of silicate dissolution in deionized water under no-low conditions in a 10-μm aperture fracture and no mechanical coupling at temperatures of 20, 60, and 120 °C. Step 1—Continue modeling of Yasuhara et al. (2006) experiment • Include the flow reversal, stop at ~1,500 hours. Step 2—Continue to end of Yasuhara et al. (2006) experiment • Includes nonisothermal portion of experiment. Step 3—Yasuhara et al. (2011) granite experiment • Develop geochemical model for granite • Simulate Yasuhara experiment data
Participant/Funding Organization	Software Used
Quintessa/NDA	QPAC and OpenGeoSys
UFZ /BGR	OpenGeoSys
CAS	Elasto-Plastic Cellular Automaton (EPCA) and TOUGHREACT
NRC	(1) Compartmental approach, modified from that in Yasuhara papers (2) HBGC123D+Aperture Module (stress incorporated only in the Aperture Module)
RAWRA/TUL	Geochemist's Workbench, Semchem software, Transport, Flow123D, FEFLOW

<table>
<tr><th colspan="2">Task C1</th></tr>
<tr><td>Summary of Discussion</td><td>1. Step 0—Groups that provided calculations achieved essentially perfect match with the experimental data; there were minor variations due to explicit consideration of density of water changes.

2. Step 1—The groups that attempted the problem got a good match again aperture and differential pressure; results improved going from Step 0 to Step 1; nobody modeled the change in aperture under no-flow, or similar changes when flow was reversed, which implies different approaches to calibration; some variability in the Si concentrations–nearly all results show steps in concentrations with flow rates which the data don't show; all need rate enhancements from the theoretical closure models, except when using the stress corrosion model; large enhancement on rates needed for free face dissolution as well; and some teams expressed concern about how we use the aperture topography data.

3. Step 2—Three models were presented, all of which represent a general form of evolution, but two of the models matched the test data better than the third model; a shutdown of the mechanical evolution at the end of Step 1 appears necessary to achieve a good match—this needs to be evaluated further; enhanced free face dissolution has to be limited at later times–need to determine whether this indicates channelization, reduction in dissolution area due to enhanced diffusion, or smoothing of surfaces.

4. Regarding fracture topography modelling: Statistical approaches to analyzing the data appear to be a good way forward; this may entail different scales (and hence areas) for

• hydrologic (channeling)
• mechanical (stress per contact area)
• chemical (reactive surface area)</td></tr>
<tr><td>Future Work</td><td>1. For novaculite experiment, teams to continue evaluating use of fracture surface data, and how to incorporate into models. Additional effort also needed to provide physical basis to quantitatively delineate stress-induced dissolution and stress corrosion processes.

2. Teams to start to consider Step 3, if appropriate. Geochemistry and chemical/mechanical effects are considerably more complex for the granite, as compared to the novaculite.</td></tr>
<tr><td>Action Items for NRC/CNWRA staff</td><td>Literature survey on geochemical data for minerals in granite to support development of a geochemical model for granite using Geochemical Workbench.</td></tr>
<tr><td colspan="2">References:
Yasuhara, H., A. Polak, Y. Mitani, A. Grader, P. Halleck, and D. Elsworth. "Evolution of Fracture Permeability Through Fluid–Rock Reaction Under Hydrothermal Conditions. Earth and Planetary Science. Letters 244. pp. 186–200. 2006.
Yasuhara, H. and D. Elsworth. "Compaction of a Rock Fracture Moderated by Competing Roles of Stress Corrosion and Pressure Solution. Pure and Applied Geophysics. Vol 165. pp. 1,289–1,306. 2008.
Yasuhara, H., N. Kinoshita, H. Ohfuji, D.S. Lee, S. Nakashima, and K. Kishida. "Temporal Alteration of Fracture Permeability in Granite Under Hydrothermal Conditions and Its Interpretation by Coupled Chemo-Mechanical Model. Applied Geochemistry. Vol. 26. pp. 2,074–2,088. 2011.</td></tr>
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<tr><th colspan="2">Task C2</th></tr>
<tr><td>Brief Description of the Overall Task</td><td>Regional flow and transport in saturated fracture network above the Bedrichov tunnel, Czech Republic, using measured data for conservative and nonconservative tracers. Constraints on flow and transport to be enhanced by utilization of natural tracers for water age from natural tracers and rock mineral dissolution to incorporate water chemical compositions.</td></tr>
<tr><td>Brief Description of the Current Task</td><td>Update steady-state hydraulics and pulse tracer and perform introductory transient hydraulics. The task involves development of the numerical models using a 2D/3D segment of the tunnel

1. Hydrological processes: (i) fit the water inflow (hydraulics); (ii) fit the lumped parameter models of tracers and (iii) fit the batch reaction experiment (crushed granite leaching)

2. Coupled processes/cross-validation: (i) develop 1D reactive transport using field chemical data; (ii) fit the isotope tracers with 2D/3D numerical transport (including hydraulics); and (iii) compare 2D/3D numerical advection with lumped parameter (fictitious tracer)

3. Additional modeling tasks: (i) refine the water inflow conceptual model and data; (ii) calculate 2D/3D transport with simplified chemistry (iii) combine/calibrate all together; and (iv) inverse method (data fitting by optimization methods) and uncertainty analyses</td></tr>
<tr><td>Participant/ Funding Organization</td><td>Software Used</td></tr>
<tr><td>TUL/RAWRA</td><td>Flow123D</td></tr>
<tr><td>SNL/DOE</td><td>PFloTran and DAKOTA</td></tr>
<tr><td>BGR</td><td>RockFlow, OGS</td></tr>
<tr><td>Summary of Discussion</td><td>The previous workshop focused on steady-state and transient hydrological processes. TUL and SNL used lumped parameter tracers and including models with “fictitious” pulse tracer. The current workshop focused on updating the steady-state hydraulics and pulse tracer models. BGR and TUL developed transient model. Real tracers were considered in the 2D/3D models. SNL team concluded that while the fracture bulk permeability was well controlled by the fracture discharge; the fracture porosity values needed additional analyses based on transport models. Observed transport velocities suggested a lower value for porosity. The TUL team included a weathered high conductive zone in their model and evaluated unsteady flow and variable location of water table. The BGR team included the unsaturated zone and had reasonable match for the observed tunnel inflow. Some of the conservative tracer transport models developed by BGR (Models 3 and 4) matched observed travel times reasonably.</td></tr>
<tr><td>Future Work</td><td>The teams will focus on detailed comparisons of results for the steady-state and transient models. Real tracer models will focus on porosity, dispersivity and diffusion. Observed concentration and residence time data will be used for calibration.</td></tr>
<tr><td>Action Items for NRC/CNWRA staff</td><td>None. NRC is not a participant in this task</td></tr>
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Technical Site Visit

Staff from IRSN led a technical visit to the Tournemire Experimental Station, which included a stop at the SEALEX drift as well as other experiments. The 120-year-old Tournemire railway tunnel was purchased by IRSN for the purpose of providing independent assessments of processes in clay host rock that play an important role in repository performance. The compacted clay and marl sequence, also described as an argillite, has similar characteristics to the Bure site in northeastern France that was developed by ANDRA, the French implementer organization. Whereas the original railway tunnel is lined, the drift excavations by IRSN use only steel ribs and mesh for precautions against incidental rock fragment detachment. Thus, direct observations of the host rock are possible for visitors to the facility. Besides the emplacement borehole sealing experiments (SEALEX), tests at the facility include (i) interactions of cement, concrete, lime, and metal with the argillite host rock (some of these materials were introduced as part of the railway activity prior to IRSN ownership); (ii) geomechanical and hydrological effects of excavation in the host rock; (iii) analysis of natural tracer migration in matrix and fractures; and (iv) in situ stress and potential for reactivation of faults.

WORKSHOP AGENDA

5th Workshop & Steering Committee Meeting

Avignon, France, 7 – 11 April 2014

Organized by IRSN

(March, 2013)

Day 1 (April 7)

12:00 - 13:00 Lunch and on-site registration

Opening and Special session

13:00 – 13:10 Address of welcome (JD. Barnichon, IRSN)
13:10 – 13:20 Opening of the Workshop and Welcome (J. A. Hudson, IC, UK)
13:20 – 13:50 Requirements for radioactive waste and its disposal in France (IRSN)
13:50 – 14:20 IRSN's research on waste disposal and its role in safety assessment (IRSN)

14:20 - 14:40 Coffee/tea break

Session 1. Task A—The SEALEX In-Situ Experiment, Tournemire Site, France (Chaired by Alain Millard)

14:40 – 14:50 Briefing for problem or step of Task A (Alain Millard, France)
14:50 – 15:20 Presentations of IRSN team (IRSN, France)
15:20 – 15:40 Presentations of CNSC team (CNSC, Canada)
15:40 – 16:00 Presentation of NDA team (Quintessa, UK)
16:00 – 16:20 Presentation of NRC team (NRC, USA)
16:20 – 16:40 Presentation of RAWRA team (UNG, Czech)
16:40 – 17:30 General discussions on Task A (Led by Alain Millard)

19:00 – 21:00 Welcome Reception

Finish day 1

Day 2 (April 8)

<u>Session 2: Task C1 – THMC of single fractures (Chaired by Alex Bond)</u>

08:30 – 08:40 Briefing for problem or step of Task C1 (Alex Bond, NDA/Quintessa, UK)

08:40 – 09:00 Presentation of BGR team (BGR/UFZ, Germany)

09:00 – 09:20 Presentations of CAS team (CAS, China)

09:20 – 09:40 Presentation of NDA team (NDA/Quintessa, UK)

09:40 – 10:00 Presentation of NDA team (IC, UK)

10:00 – 10:20 Coffee/tea break

10:20 – 10:40 Presentation of NRC team (NRC, USA)

10:40 – 11:00 Presentation of RAWRA team (TUL, Czech)

11:00 – 11:20 Presentation Professor Ivars Neretnieks

11:20 –11:40 General discussions on Task C1 (Led by Alex Bond)

12:00 - 13:00 Lunch

<u>Session 3: Task C2 – Bedrichov Tunnel Test Case, Czech Republic (Chaired by Milan Hokr)</u>

13:00 – 13:10 Briefing for problem or step of Task C2 (Milan Hokr, Czech)

13:10 – 13:30 Presentations of DOE team (SNL, USA)

13:30 – 13:50 Presentation of RAWRA team (TUL, Czech)

13:50 – 14:10 Presentation of BGR team (BGR, Germany)

14:10 – 14:20 General discussions on Task C2 (Led by Milan Hokr)

14:20 – 14:30 Coffee/tea break

14:30 – 16:30 ***<u>Planning session for Decovalex 2019</u>***

16:30 – 17:30 ***<u>Task Force Meeting for Task A (Led by Alain Millard)</u>***

Finish day 2

Day 3 (April 9)

<u>Session 4: Task B1— HE-E Heater Test, Mont Terri, Switzerland(Chaired by B. Garitte)</u>

08:30 – 08:40 Briefing for problem or step of Task B1 (Benoit Garitte, NAGRA,Switzerland)

08:40 – 09:00 Presentations of BGR/UFZ team (BGR/UF, Germany)

09:00 – 09:20 Presentation of CAS team (CAS, China)

09:20 – 09:40 Presentation of DOE team (LBNL, USA)

09:40 – 10:00 Presentation of ENSI team (ENSI, Switzerland)

10:00 – 10:20 Coffee/tea break

10:20 – 10:40 Presentations of IRSN team (IRSN/CNSC, Canada)

10:40 – 11:00 Presentation of JAEA team (JAEA, Japan)

11:00 – 11:20 Presentation of KAERI team (KAERI, Korea)

11:20 – 11:40 Presentation of NRC team (CNWRA/SWRI, USA)

11:40 – 12:00 General discussions on Task B1 (Led by Benoit Garitte)

12:00 - 13:00 Lunch

<u>Session 5: Task B2— EBS Experiment, Horonobe, Japan (Chaired by Yutaka Sugita)</u>

13:00 – 13:10 Briefing for problem or step of Task B2 (Yutaka Sugita, JAEA, Japan)

13:10 – 13:30 Presentation of BGR team (BGR, Germany)

13:30 – 13:50 Presentations of CAS team (CAS, China)

13:50 – 14:10 Presentation of DOE team (LBNL, USA)

14:10 – 14:30 Coffee/tea break

14:30 – 14:50 Presentation of JAEA team (JAEA, Japan)

14:50 – 15:10 Presentation of KAERI team (Inha University, Korea)

15:10 – 15:30 General discussions on Task B2 (Led by Yutaka Sugita)

15:30 – 16:30 ***<u>Task Force Meeting for Task C1 (Led by Alex Bond)</u>***

16:30 – 17:30 ***<u>Task Force Meeting Task C2 (Led by Milan Hokr)</u>***

18:30 – 21:00 Dinner

Finish day 3

Day 4 (April 10)

08:30 – 09:30 ***Task Force Meeting for Task B1 (Led by Benoit Garitte)***

09:30-10:30 ***Task Force Meeting for Task B2 (Led by Yutaka Sugita)***

10:30 – 12:30 **Steering Committee meeting**

12:30 - 13:30 Lunch

Starting of Technical visits

Technical visit Millau Viaduct

14:00- Leaving Avignon and staying the next night in Millau (30 km from Tournemire URL)

16:30 -Visit of Millau viaduct

18:00 leaving Millau viaduct to Millau city center

18:15- Guided tour - Millau city center

19:15- Hotel Mercure Millau

Finish day 4

Day 5 (April 11)

07:30 – 15:30 **Technical visit: Tournemire URL+ Roquefort cave**

07:30- Departure from Millau Mercure hotel

08:10- Tournemire URL

8:10-8:30 Coffee/tea break

8:30-9:30 Presentation -Tournemire URL

9:30-9:45 Coffee/tea break

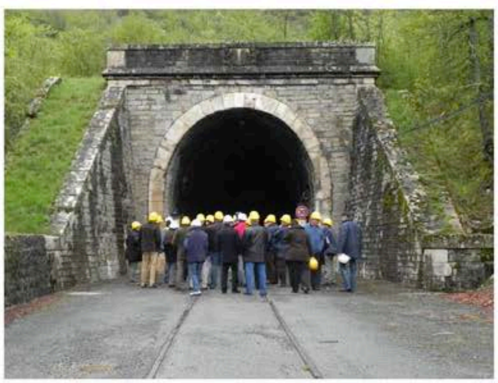
9:45 Visit of Tournemire URL

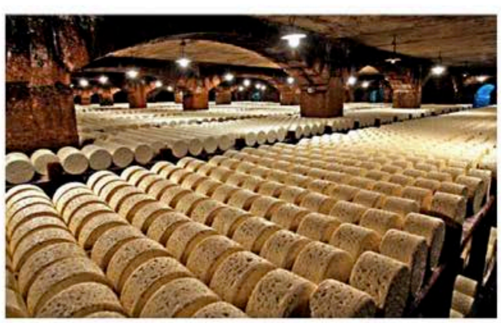
12:30-14:00 Lunch

14:30-15:30 Visit of Roquefort cave

15:30 Back to Montpellier

17:00- 18:00 Montpellier railway station/ airport





PRACTICAL INFORMATION

Accommodation

at Avignon

The 5th DECOVALEX –Workshop will be held in **Hotel Mercure Pont d'Avignon**. Located two minutes from the Opera and the Pont d'Avignon, this Mercure hotel enjoys a location of choice right in the city center close by the Palais des Papes and the station.

A number of rooms are **pre-reserved** in Hotel Mercure Pont d'Avignon and Hotel Mercure Cité des Papes (see map).

Please note that you should **book your room by your own**. The rooms are reserved under the **code "IRSN/D2015".**

At Millau: technical visit, 10 April 2014

- Bus transportation from Avignon to Millau (30 km from Tournemire URL), about 2.5 hours' drive.
- Overnight stay **at Millau Mercure Hotel**. **Rooms are already booked** for the participants to the technical visit

Venue

To reach Avignon:

- Flight to Paris+ Train,TGV to Avignon. For time table please visit the website http://www.sncf.com/en/passengers

11 April 2014 bus transportation from Tournemire to Montpellier railway station/ airport

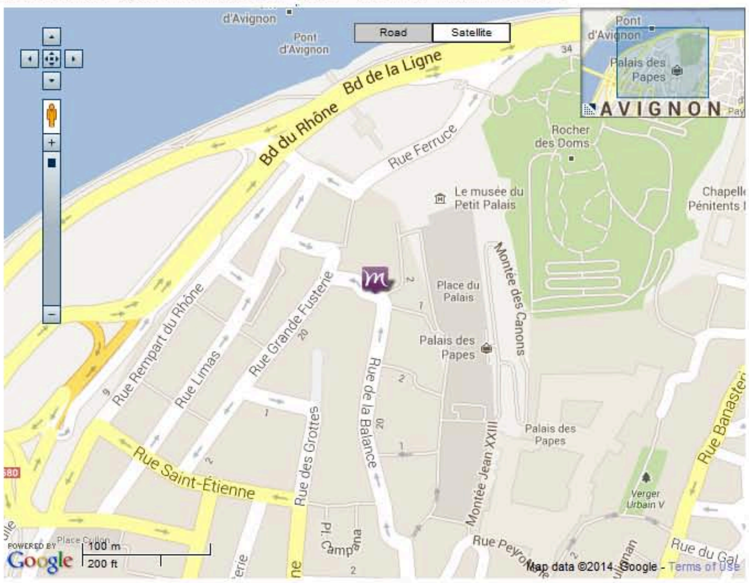
To Reach Paris:

- From Montpellier airport: Flight to Paris Airport CDG/Orly.
- From Montpellier railway station: TGV to Paris.
  For time table please visit the website http://www.sncf.com/en/passengers

LOCATION MAPS

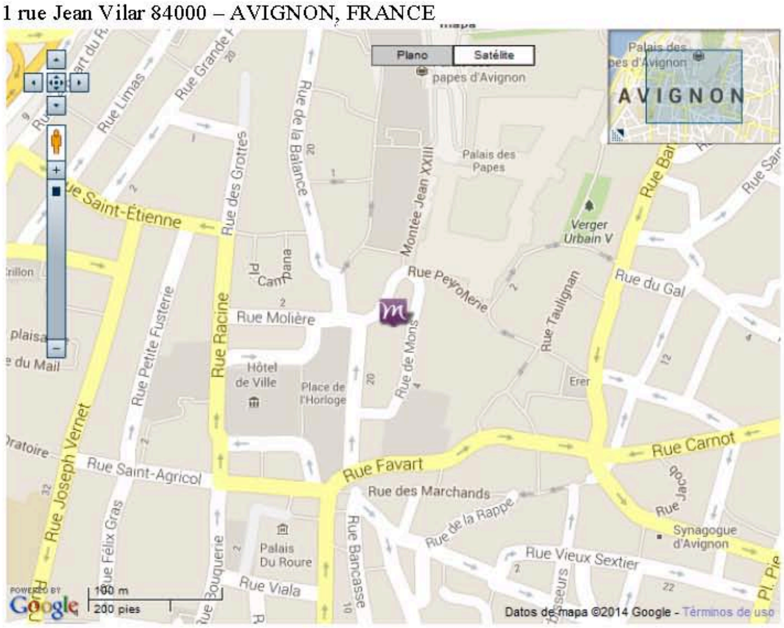
Hotel Mercure Pont d'Avignon

Rue Ferruce Quartier Balance 84000 – AVIGNON, FRANCE

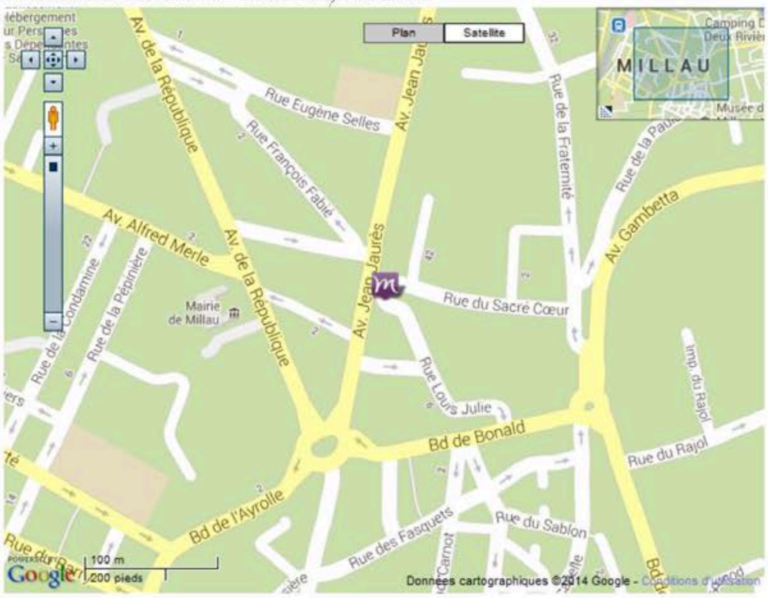


Hotel Mercure Cité des Papes

1 rue Jean Vilar 84000 – AVIGNON, FRANCE



Hotel Mercure Millau
1 Place de la Tine12100 – MILLAU, FRANCE



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