IP FUNMIG

3rd Interim Activity Report

Report to D0.17 "3rd Semi-Annual Activity Report (30 Project Months)

Date: 09.07

Submitting organizations: FZK-INE and ENVIROS

Dissemination level: Public (CO)

Foreword

The present report gives a brief overview of the IP FUNMIG project activities during the project months 25-30. The report focuses on work progress follow-up, follow-up of response to the 2nd Annual Project Review, and handling of major problems. The report is submitted by the Coordination Team, supported by RTDC leaders and individual Contractors, as required.

Summary

The activities and progress for the IP FUNMIG project months 25-30 may be summarized as follows:

- The different planned R&D activities have, with minor deviations, progressed according to schedule. Correspondingly, timely submission of Deliverables, Project Internal Deliverables and achievements of Milestones reflect that the Project as a whole is progressing well.
- The outcome of the 2nd Annual Project Workshop has been documented in the form of Workshop Proceedings, presently in print as an SKB Report.
- Preparations for the 3rd Annual Project Workshop are in good progress.
- The number of Associated Groups has increased steadily and has now reached 28.
- Preparation for the third training course is in an advanced state.
- The second annual project review took place and all follow-up activities have been implemented.
- The second project year reporting has been finalized, forwarded to the Commission for final acceptance, as the prerequisite for the 3rd Advance Payment.

In summary, the Project is progressing well with few minor deviations from the work plan that do not endanger the overall project schedule and performance. Where major problems have been encountered, appropriate actions have been taken and the associated problems appear to be have been solved in an acceptable way.

Table of contents

1. Project objectives and major achievements during the reporting period

The overall objectives of the present semi-annual project period are to:

- Ensure continued good performance of the Project, reflecting the Project work plan,
- Incorporate recommendations from the 2nd project review in order to further improve project performance,
- Finalize the 2nd project year reporting with accompanying activities providing the basis for work and activities to be conducted during the 3rd 18 Months Implementation Period,
- Provide the basis for the Commissions acceptance of the 2nd project year and request the 3rd Advance Payment, and
- Make preparations for the final reporting.

With few exceptions, the work is progressing according to schedule. Where difficulties have been encountered, adequate measures have been taken and remedial actions appear to provide for the desired outcome (section 2).

Deliverables on a Consortium management level are discussed under section 3. Due to its key importance in view of finalization of the Project, in this section, also the final reporting system is discussed. Additional input from the 2nd Annual Project Review to the final reporting system is also discussed under section 6.

Project Internal Deliverables and Milestones due during the present reporting period are discussed in section 4. The timely submission of deliverables and milestones is the key tool for overview monitoring the S+T progress. The formal Deliverables (D), Project Internal Deliverables (PID) and Milestones (M) reporting documents are made available at the Project Intranet Site ("Reporting 30 Project Months"). These formal reporting documents are frequently associated with underlying more detailed documents, such as reports, presentations, minutes and/or publications. Such underlying documents are also placed at the Project Intranet Site. For insight into the progress on individual topics, the underlying documents need to be consulted.

A general overview over the progress on a RTDC and WP level is given in section 5. Given the detailed reporting in the annual reporting, the present semi-annual reporting is focusing on performance follow-up.

The first project review was held 20 March 2007, in Brussels. The outcome and measures taken are documented in the 2nd Annual Project Reporting. The follow-up at the present stage is discussed in this report (section 6). A key achievement of the Project at the present stage is having generated an adequate strategy, work procedures and working documents in order to

meet the expectations in view of making the project outcome useful for its implementation in PA/the Safety Case.

Another issue subject to 2nd Annual Project Review follow-up concerns the final reporting system (cf. also section 3). As discussed already during the third GovBoard meeting, directly after the 2nd Annual Workshop in Stockholm, and reconfirmed by the 2nd Annual Project Review, a clear strategy, and associated agreements and practical arrangements are required already at this stage in view of the final project reporting. The approach to the final reporting has been agreed upon (see 2nd Annual Project Reporting: "Management, Activity and Integration Report"). In view of 2nd Annual Project Review comments, further refinement of the approach is discussed in section 6.

Consortium management issues are discussed under section 7. From the onset of the project, efforts have continued to simplify reporting and lower the burden for Contractors and RTDC leaders. This approach also found support in the annual project reviews. The outcome is that (i) the number of Deliverables has decreased, for example through merger of annual management, activity and integration reports, (ii) RTDC progress is reported through the Annual Workshop Proceedings, avoiding reproduction of information or generation of unnecessary text material, and (iii) ensuring that the S+T outcome is documented over various existing channels, using the PID's as monitoring and documentation tools.

In summary, the achievements during the present semi-annual reporting period reflect the objectives and ensure continued good performance of the Project.

2. Major problems encountered

In the present reporting period, no new major problems were encountered. The existing problem of lack in performance of one Contractor seems to have lead to an acceptable solution. Notwithstanding considerable delay, the work agreed upon in the Contract will be delivered.

The problem was associated with Contractors No. 21 (KTH) where one of the work groups is involved in RTDC4. Contrary to the contractual agreement, work had not started at the end of the 2nd project year. The agreement between the Coordinator, the RTDC4 leader and the Contractor was that funding would be withdrawn and the allocated resources redirected to another activity, in agreement with the ExCom, unless the Contractor can show by project month 30 that work has started and that there is the perspective of achieving the objectives before the end of the Project. Now, after 30 project months, the Contractor has delivered a progress report, showing that a promising experimental program has started up. The key responsible person at the Contractor has verified that there is a good perspective that the objectives will be achieved before the end of the Project.

Table 3.1: Project Management related Deliverables and Project Internal Deliverables on Project level covering the period up to project month 30.

Ref.	Title
	Management related **Deliverables**
D0.1	Performance Indicators
D0.2	Annual Activity Report
D0.3	Annual Management Report
D0.4	Annual Funding Distribution Report
D0.5	2nd 18 months Implementation Plan
D0.7	Annual Integration Report
D0.8	Annual Workshop Proceedings
D.0.9.	Annual Cost Statements and Audit Certificates
D0.10	Project Presentation
D0.11	Communication Action Plan
D0.12	1st Semi-Annual Activity Report (6 Project Months)
D0.13	2nd Semi-Annual Activity Report (18 Project Months)
D0.14	2nd Annual Activity Report (24 Project Months)
D0.15	2nd Annual Management Report (24 Project Months)
D0.16	2nd Annual Workshop Proceedings (30 Project Months)
D0.17	3rd Semi-Annual Activity Report (30 Project Months)
	Management related Project **Internal** Deliverables
PID0.1	Key Milestones for full duration of the project
PID0.2	Contractors Annual Activity Reports
PID0.3	Contractors Annual Management Reports
PID0.4	Contractors annual reports on the use of financial resources
PID0.5	Contributions to 2nd 18 moths implementation plan
PID0.7	Contractors Annual integration reports
PID0.8	Contractors contribution to 1st Annual Workshop Proceedings
PID0.9	Contractors contribution to 1st Semi-Annual Activity Report
PID0.10	2nd Semi-Annual Activity Report (18 Project Months, through RTDC leaders)
PID0.11	Contractors 2nd Annual Management Reports (24 Project Months)
PID0.12	Contractors Cost Statements and Audit Certificates
PID0.13	Contractors contributions to 2nd Annual Workshop Proceedings (24 Proj. Months)

3 Deliverables (Consortium level) and final reporting system

The Deliverables on a Consortium level (D0.x and PID0.x) up to project month 30 are listed in Table 3.1. D0.17 refers to the present report.

3.1 2nd Annual Workshop Proceedings

With respect to the 2nd Annual Project Workshop Proceedings, the review by external experts of the S+T contributions was conducted the two days following the Workshop. The review comments were sent out to the authors of the S+T contributions and the review follow-up has been finalized. After editing, the 2nd Annual Project Workshop Proceedings are now in print as an SKB report (SKB as the host of the Workshop).

3.2 The final reporting system

The final reporting system is documented in the 2nd Annual Project Report. A question raised in the 2nd Annual project Review was that it would be beneficial to have external review of the key reports. As discussed in the 2nd Annual Project Report, the overview and summary report is published by the Commission. Consequently, the Commission is requested to take care of this issue. With respect to other key reports, specifically related to WP6.1 and 6..2, the responsible organizations will arrange for external review (cf. section 6).

4. Project Internal Deliverables and Milestones

Formal Deliverable (D), Project Internal Deliverable (PID) and Milestone (M) documents, together with accompanying documents/reports and listing of D's, PID's and M's with their status, are available at the Project Intranet site, under: "FUNMIG IP / Reporting 30 Months". The PID's and Milestones due in the present reporting period are also listed in Table 4.1, and if required, commented upon in Table 5.1.

Table 4.1: Project Internal Deliverables and Milestones, due during the present reporting period.

Project Internal Deliverable (PID)		Organization(s)	Project Month
PID1.1.3	Publication on U-sulphate system in temperature	CEA	30
PID1.2.5	Report on Cm(III)/Eu(III) sorption onto aluminumoxides/hydroxides	FZK	30
PID1.2.18	Compilation of existing sorption and diffusion data for Cs, Sr, Am/Eu on Clay host rock materials – outcome of the questionnaire	SCK-CEN	30
PID1.2.21	Compilation of existing sorption and diffusion data for Cs, Sr, Am/Eu on Clay host rock materials – outcome of the questionaire	SCK-CEN	30
PID1.3.5	Report on quantitative sorption data on the Am(III) sorption onto kao-linite in the presence/absence of humic substances.	FZR	30

PID1.3.6	Report on the characterization of organic matter-clay association in synthetic and natural systems	FZK-INE	30
PID1.3.8	Joint with, provide a database of binary and ternary/competition experimental data, including humic acid	UNILOUGH UNIMANCH	30
PID1.3.9	Physicochemical mechanistic model that is capable of interpreting binary and ternary systems simultaneously, including the effects of humic substances	UNILOUGH	30
PID1.4.5	Update report on the uptake of actinides by calcite	FZK-INE	30
PID2.2.13	Report on the evolution of the excitation and emission fluorescence spectra of lanthanide (III) with fractionated organic matter.	CEA	30
PID2.2.15	Report on natural radioelements sorption and complexation properties of immobile OM extracted from real site conditions	NRI-REZ	30
PID2.2.16	Report on $UO_2(OH)_2$ and UO_2CO_3 solid phase characterizations by ATR-FTIR, XRD, TGA and TEM	UNICYPRUS	30
PID2.2.17	Joint progress report on the interaction of radionuclides with mobile and immobile natural organic matter – UPDATE of PID2.2.8 (KUL will have finished most of their work, but SCK•CEN is still continuing his efforts, therefore the update will mainly include the part of SCK•CEN which was limited in the 1st reporting period.)	SCK•CEN KULeuven	30
PID2.3.7	Report on U immobilization and mobilization by mineral surfaces using thin-film flow-through reactor experiments	KTH	30
PID2.3.8	Report on the attachment probability of green rust colloidal particles for typical far-field fracture-filling materials.	KU	30
PID2.3.9	Reports on reaction between green rust and selenium.	KU	30
PID2.3.10	Report on solubility product of green rust	KU	30
PID3.1.6	Report describing the preliminary version of the mono-porosity mechanistic model and associated database for one radioelement for Callovo-Oxfordian clay rock conditions.	ARMINES	30
PID3.2.1	Mineralogical characteristics of the Opalinus Clay (DR experiment) and COx; complete. Comparison with the existing databases	CIEMAT	25
PID3.2.12	Report on results of diffusion experiments in Opalinus clay including comparison to literature data	FZK-INE	30
PID3.2.14	Report of results on the HTO and 85Sr large scale diffusion experiment	CIEMAT	30
PID3.2.15	Report on diffusion experiments with OPA clay at laboratory scale.	CIEMAT	30
PID3.3.4	Feasibility study on a large-scale, in-situ migration experiment in Boom Clay with strongly sorbing tracers.	SCK·CEN	30
PID3.4.6	Progress report on the modelling of tracer profiles with two models of different complexity	GRS	30
PID4.1.3	Progress Report on Fe and Mn studies	HU	30
PID4.1.4	Report with interpretation of groundwater analysis data obtained from the new and old boreholes.	CIEMAT	30
PID4.2.4	Progress report on laboratory activities	HU, CIEMAT, OVIUNI	30

PID4.2.5	Progress report on analysis, processing of data from the geophysical data acquired at the FEBEX gallery.	CSIC	30
PID4.2.6	Update report on colloid and radionuclide transport in a well characterized bore core.	FZK-INE, JGUM, IIF	30
PID4.4.3	Update report on bore core experiments on bentonite colloid generation and impact on RN transport	FZK-INE, CIEMAT	30
PID4.4.6	Report on migration and retention properties of the Czech granitic reference samples.	NRIRez	30
PID4.5.3	Up-date report on geochemical and hydrological processes identified from real site data.	GEOPOINT	30
PID4.5.4	Report on the use of U isotopes in characterizing groundwater flow system in glaciated crystalline rocks	HU	30
PID4.6.6	Report on the development of up-scaling techniques	UPV	30
PID5.2.3	Up-date report on development and application of μ-XRF, μ-XAFS and μ-XRD for sample analysis.	FZK-INE	30
PID5.3.2	Report on data integration with regard to the behaviour of organic matter and uranium in the system	NRI-REZ, GRS	30
PID6.2.2	Interim report on current treatment of investigated processes in PA	NAGRA with the support of other WMOs and the IMG	30
PID6.3.1b	Definition and implementation of a database for new sorption data obtained within the project	FZK-INE, FZD	30
Milestones			
M1.2.3	Surface Complexation Model describing the adsorption of Se(+IV) and Se(+VI) on Illite du Puy	KULEUVEN	30
M1.3.1	Generation of quantitative and qualitative data on the Am(III) sorption onto kaolinite in the absence and presence of humic substances.	FZR	30
M1.3.3	All binary and ternary experiments completed	UNILOUGH	30
M2.2.9	Validation of Donnan Membrane for Th(IV)	CEA	30
M2.2.10	Provision of structural data on Se(+IV)/Se(+VI) – humic substance reaction products to define the type of interaction (i.e. complexation, colloid-colloid formation)	KULEUVEN	30
M2.3.4	Provision of interaction mechanism (i.e. sorption, reduction, solubility) between pyrite and siderite and selenium oxy-anions in order to define the impact of reducing minerals on selenium retention.	KULEUVEN	30

5. Progress within the reporting the period

An overview of the project activity follow-up during project month 25-30 is given in Table 5.1. The information in the table is provided by the RTDC leaders and the Coordination Secretariat (Component 7). The reporting focuses on documentation of progress, major prob-

lems encountered and deviations from the work schedule. Documentation of the S+T progress will be done in detail in the forthcoming 3rd Project Year Reporting.

The work is progressing well. As expected, in few cases work is delayed or redefined based on unexpected difficulties, new findings or change in orientation of work. Amendment of the work program will be documented in the forthcoming more detailed 3rd Annual Project Reporting and the associated final implementation plan.

Table 5.1: Performance follow-up of S+T work as well as activities within Component 7. If major problems are encountered or if there is deviation from the work schedule as of the 3rd 18 Months Implementation Plan, this is noted in the table and detailed at the subsection of the table (below).

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
1.1	Determination of missing key thermodynamic data.	Thermodynamic data of U(VI) sulphate system has been acquired. Hydroxosulphatouranate(VI) complexes evidenced. Common study (CEA-CTH) of Eu(III) silicate system has begun.	PID 1.1.3	none
1.2	Quantification and spectroscopic characterization of the radionuclide sorption by minerals surfaces.	Identification of sorbed Cm(III) species on gibbsite Influence of inorganic carbon on U(VI) and Ni(II) sorption; competition of Fe(II) Application of Silicate data from CEA-CTH to Eu(III) sorption on Illite. Mineral slices necessary to CTH program are now available. Use of polarized EXAFS helped in clarifying sorption mechanisms of lanthanides and actinides Illite-Eu-Boom clay humic acid system is a totally competitive system, and can be modelled	PID 1.2.5, 18., 21	PID 1.2.18 and 1.2.21 from SCK-CEN will be merged. Due to internal SCK constrains, this PID will be slightly delayed, hopefully before the T+45 period.

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
1.3	Influence of organics on the retention of radionuclides by minerals	Spectroscopic evidences of a change in surface speciation of Am(III) on kaolinite in the presence humic acids. Different evironment depending on pH. non-homogeneous distribution of aromatic and natural organics in the clay interlayer evidenced in XRD. The C(1s) spectra indicates a high aliphaticity of the kerogen from Callovo Oxfordian and a considerable amount of carboxyl-type groups. Linear additive model can be use as operational model for ternary surface-metal-humic systems, but only in their parametric domain.	PID 1.3.5, 6, 8, 9	PID1.3.8 on validation
1.4	Study of formation of solid solution and secondary phases, including retardation of anions	No effect of compaction of the sorption results of Se(IV) on (re)compacted and dispersed illite. Elucidation of the structural incorporation of Np(V) in calcite.	PID 1.4.5	
2.1	Formation of UO_2(cr) and $UO_2 \cdot xH_2O$(am) colloids. Radionuclide speciation in the bentonite porewater/ granite groundwater mixing zone.	The pH of colloid formation onset can be used to derive the solubility products of UO_2(cr) and $UO_2 \cdot xH_2O$(am). No interaction between the UO_2 colloids and dissolved Al(III), but strong interaction with silicate. EXAFS investigations are underway to elucidate the process. Trivalent actinide speciation (I.e. Cm) is influenced by the Febex porewater/ Grimsel ground water mixing zone at low Febex porewater (<15%) admixtures, no incorporated Cm species observed.	-	
2.2	The effect of humic Acid on the stability and solubility of UO2(OH)2 and UO2CO3 solid phases.	$UO_2(OH)_2$ and UO_2CO_3 are stable and remain the solubility limiting solid phases even in the presence of humic acid (up to 0.5 g/l). The presence of humic acid affect texture and particle size of the solid phases. The stability constant for the UO_2OH(HA) species has been evaluated to amount $\log ß_{1101} = 15.3 \pm 0.5$ at pH 6.5.	PID 2.2.13, 15, 16, 17	

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
	U(VI) sorption and complexation properties of immobile OM extracted from real site conditions (Ruprechtov).	HA were isolated from Ruprechtov sediments and characterised. Natural U distribution showed increasing trend of U adsorption on sample with higher TOC content. Due to difficulties during HA separation from clay-horizon samples, complexation experiments using ^{233}U are slightly delayed will be accomplished within the third project year.		
	Interaction of Am/Th with mobile and immobile natural organic matter (NOM) from Boom Clay	Immobile NOM phase plays a role in the Am/Th sorption but sorption to the mineral phase remains important. The role of the remaining carbon fraction called "MIN" phase is however unknown, FTIR did not show any HA functional group capacity.		
	Influence of BCNOM on the solubility of Eu(OH)3: Complexation versus Colloid formation	The influence of NOM on the solubility of Eu was very distinct but dependent on the operational size cut-off used to distinguish between solid and solution phase.		
	Influence of NOM on the sorption behaviour of Eu on illite	The ternary sorption systems could be modelled without taking into account Eu colloid formation and interactions between NOM and illite.		
	Fractionation of organic matter on mineral surfaces	Results confirm that a linear additive model is difficult to apply to NOM (HA/FA) that undergoes a sorption reaction as the "thermodynamic object" as NOM is fractionating during the sorption reaction.		
	Structural data for Se(+IV) and Se(+VI) humic substance reaction products	XANES/EXAFS data of the Boom Clay HS samples showed that mainly SeO_3^{2-} species are present in the supernatant solution, and confirmed that Se(0) was formed and precipitated in the pellet.		
	Application of flux Donnan Membrane technique (FDM) for Th(IV)	Using FDM in the U(VI)-humic acid system showed precipitation of a low solubility mineral at the surface of the Donnan membrane, hindering the transport of free metal from the donor to the acceptor side of the apparatus. It means		The PM's (CEA) were reallocated to study the competition between

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
		that for Th(IV), the awaited concentration factor of Th^{4+} should be close to 8×10^5 limiting the applicability domain for this low soluble element.		Ca^{2+}/Eu^{3+} and Cu^{2+}/Eu^{3+} for humic competition in collaboration with UPPC (Potentiometric (Ca, Cu) study and TRLFS (Eu).
2.3	Interaction mechanism between pyrite and siderite and selenium oxyanions. Determination of UO_2^{2+} sorption at reducing and non-reducing mineral surfaces in bicarbonate solutions. Green Rust colloidal particles and sticking factor	The reduction of Se(IV) to Se(0) in presence of pyrite was confirmed by XAS measurements. XPS indicate U(VI) reduction by Fe(II) in the minerals magnetite and biotite. Thin-film flow-through reactor experiments show that uranyl (im)mobilization is strongly pH dependent and that uranyl retention by hematite is up to six-fold higher than by magnetite. Green rust attachment behaviour measured by AFM to 11 substrates chosen to represent common natural solids (muscovite, biotite and chlorite, on feldspar, quartz and glass, on calcite, gypsum, corundum, hematite, and on graphite) are accomplished.	PID 2.3.7, 8, 9, 10	
2.4	The effect of iron mineral transformations induced by microbial mediated changes in redox regime on the mobility of radionuclides. Ferric iron oxide sorbed U(VI) mobilisation during S(II) induced iron reduction. Sorption experiments of Cs, Co, Am and Th onto biofilm grown in Äspö	Application of XAFS showed that the immobilization of U(VI) caused by formation of biogenic magnetite or by Fe(II) production seems not to be related to reduction to U(IV). XAS analyses show that slow reduction of U(VI), presumably by FeS, can account for a re-immobilization of uranium as an U(IV) precipitate. Results available second half of 2007.	-	

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
3.1	develop a scale of redox reactivity of argillite rocks (Fe(II))	Siderite observation by SEM and electron microprobe; estimation of solubility based on solid-solution model; estimation of upper value for CE Fe(II); idem dissolved Fe; oxidation kinetics of COx by O2 (BRGM)		
	develop model of anion exclusion in argillite media	in progress (BRGM)		
	develop M.D approach for modelling clay edges, confront with experimental data	MD models of H2O, cation and anion distribution near Na & Ca-montmorillonite surfaces (BRGM, AIED, LMPC) NMR measurements to determine water state and anion accessible porosity (Subatech, LPEC, LMPC)		
	investigate structural parameters for Eu, Sm hydration, hydrolysis, redox state in synthetic montmorillonite interlayer	Neutron diffraction w/ isotopic substitution experiments carried out on 'Eu-montmorillonite – H2O'; chemical analysis of ' Sm - montmorillonite – H2O' samples (UJF, LMPC)		
	develop molecular model for Se(IV) redox reactions in presence of Fe(II) sorbed onto montmorillonite	Clay/Fe(II)/Se(IV) kinetic experiments carried out; Mössbauer determination of Fe speciation variation on addition of Se(IV); time resoved Se-K XANES of clay/Fe(II)/Se(IV) system (UJF) Development of redox potential measurements using one electron sensor molecules (UJF) *in progress*		
	perform diffusion and advection experiments on a compacted synthetic Mg-montmorillite	Programmed to begin 2nd half 2007 (CEA)		

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
	Development of mono-porosity model and database for Rn sorption in Bure–claystone. Interpretation by a coupled surface complexation/ion exchange model obtain data needed to make conceptual model of water and porosity distribution in clayrocks	NMR measurements to determine state of water in compacted clay interlayers and micropores (Subatech) Work in progress on including effects of electrical double layer (Subatech) Database for Cs sorption on COx argillite considering illite as representative clay mineral (Subatech) Measurements completed; preliminary model predictions of water amount available for chemical reactions in progress (Ciemat)	PID3.1.6	09.2007
3.2	Measurment of diffusion of strongly sorbing radiotracers (^{152}Eu, ^{60}Co) in OPA inter-laboratory comparison & of retention parameters onto clay host rock materials migration tests (through-diffusion type) onto Boom Clay with the selected sorbing tracers Cs, Sr and Eu/Am analysis & modelling of large scale test experimental data for Opalinus	Sorption isotherms + Through-diffusion & in diffusion of Cs in OPA, modeling; Sorption & in diffusion of Co, in diffusion of Eu using direct application on surface (on going); development of new diffusion cell (PSI) Comparison of results from long term experiment on Cs migration in Boom clay with Kd measurements (obtained in RTDC1) (SCKCEN) Programmed 11/2007 Large-scale expts. Running for Cs, Co, Eu in Opa; idem Cox; data analysis and interpretation of data sets for HTO & Sr	PID3.2.1	OK

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
	and Callovo-Oxfordian clay	diffusion in Opa and Cox finished (Ciemat)	PID3.2.14 PID3.2.15	OK OK
	Analysis of diffusion using the RBS technique on Opalinus clay	RBS spectra obtained for clay + Eu; diffusion profiling by RBS not possible for clay + Sr (Ciemat)		
	characterization of Boom Clay	In progress (Ciemat)		
	Diffusion experiments in autoclave (Pu, Am, Np) on Opa and Bure rock samples. reactive-transport modelling of results	Results for Pu and HTO diffusion in Opa obtained and compared with lab results (PID3.2.12), other measurements underway as scheduled (INE)	PID3.2.12	OK
	through-diffusion measurements on samples originating from new borehole in Boda Claystone	Measurements underway and on schedule for TcO4, H14CO3, HTO through diffusion (II-HAS)		
	isolate, purify, characterize, determine behaviour of organic matter mobilized by alkaline perturbation of COx kerogen	Quantification of 2 types of functional groups on mobilized OM (carboxylic, phenolic); percolation tests carried out (Subatech)		
	Continue development of the electronic system of the *2D-beta imaging* system	In progress (Subatech)		
	Perform in-diffusion experiments on COx argillite (Cu, Eu, Li); determine diffusion profiles, mineralogical maps by LIBS microprobe.	First set of in diffusion experiments underway since 1/2007 (CEA)		
	LIBS microprobe development to improve detection of halogen and other elements with high excitation energies	In progress (CEA)		

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
	measure diffusion parameters using column set-up (Eu, Cs, Se). Test models	Method validation completed (measurements, modeling) for Li, Na, Cs; experiments with Eu underway (CEA)		
	Compare LIBS microprobe and microabrasive methods	In progress (CEA, PSI)		
	Characterize microstructure of COx, Opa, Boom, Boda clays; establish links between microstructure and diffusion experiments	Carried out on Boda and Boom samples (completing Cox comparative dataset)		
	Development and application of TDD model for forward and inverse modelling of in diffusion	Thesis of JC Robinet (Andra financed) on schedule		

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
3.3	Coordination of experimental and modelling work related to the DR experiment at Mont Terri.	In progress (Nagra, PSI)		
	Modelling of the DR in-situ experiment.	Verification of simulations of anisotropic diffusion in cylindrical coordinates; model comparisons (PSI, GRS, UDC)		
	Comparison of retention data to that obtained from lab studies	first comparisons of simulations to DR data (PSI, GRS, UDC)		
	Carry out sensitivity analysis for the design of the DR experiment (Mont Terri); evaluate role of the EDZ.	Completed (UDC)		
	Carry out scoping calculations and interpretation by numerical modelling of "solid source" experiments	Underway (UDC)		
	model results of *in situ* diffusion experiment using two codes of different complexity; analyze influence of anisotropy, advantages, disadvantages of the 2 levels of model complexity	Completed, no major improvement in data simulation found in using more complicated model (GRS)		
	report on the feasibility of a large-scale in-situ migration experiment in BC with strongly retarded tracers	Completed (SCKCEN)	PID3.3.4	OK
	Interpretation of long-term running large-scale in-situ migration experiments with C-14 labelled natural organic matter in Boom Clay	In progress (SCKCEN)		
	sensitivity study of a generic in situ tracer injection experiment characterized by 2 data acquisition phases	Programmed end 2007-08-14		

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
3.4	up-scaling strategy for incorporating the (possible) effects of spatial variations in Callovo-Oxfordien mineralogy (and associated physical-chemical properties) on the representation of radionuclide transport parameters values (De, w, Kd) in a PA model	Geostat analysis of log data completed (M. Lefranc thesis); measurement of diffusion (HTO, Cl, Cs) and retention parameters (Cs) underway on samples of varying CO3 content (Andra)		
	Evaluate carbonate content influence on COx diffusion parameters : diffusion measurements (HTO, ^{36}Cl, ^{22}Na or ^{137}Cs); perform complementary analyses	Underway (data for above action) (CEA)		
	Analysis of dissolved He profiles in the Opalinus clay anticline (Mont Russelin tunnel, Mont Terri project) and the corresponding values in the boundary condition imposing groundwaters in adjacent aquifers.; Interpret and model data for natural tracers (He? Cl, Br, $\delta^{18}O$, $\delta^{2}H$)	Drilling, sampling and lab analyses have been conducted; numerical modelling is in progress (U. Berne)		
	development of a geographical information system (GIS) at the COx scale, including a regional description of the porewater composition	Updated version completed, data entry on going (BRGM)		
	Model data from selected existing tracer profiles using analytical, numerical models; evaluate relative advantages / disadvantages.	Modelling of stable isotope (Benken) and He (Mont Terri) data using different complexity models completed (GRS)	PID3.4.6	OK

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
4.1	Study of the mass transfer from bentonite to granite in realistic conditions. Study of past redox parturbations by the analysis of Fe/Mn oxyhydroxides.	Analysis, interpretation and modelling of the first sampling water and colloid campaigns at the FEBEX site.	PID 4.1.4 (CIEMAT)	PID4.1.3 (HU) Will be delayed to M36
4.2	Study of the flow system around the FEBEX gallery with high resolution techniques and of the connections of interest for ion transport. Characterisation of rock samples as a support of migration laboratory experiments.	Analysis and interpretation of geophysical data acquired at the FEBEX site with the identification of a conductive fracture parallel to the tunnel.	PID 4.2.4 (HU, CIE, OVIUNI) PID 4.2.6 (FZK-JGUM, IIF) PID 4.2.5: (Information pending)	
4.3	Study of the bentonite colloid generation from compacted bentonite. Study of colloid filtration processes as a function of the size and charge.	The compaction degree of the bentonite is important on the first stage of generation process, chemistry and clay-type affect the stability of generated colloids. Roughness effects are dominant for filtration, when the electrostatic is unfavourable.		
4.4	Study of the radionuclide (in presence/absence of colloids) with laboratory experiments at different scales.	Mounting of the mock-up experiment and modelling. Dependence on colloid size of colloid transport in a fracture.	PID4.4.3 (CIEMAT, FZK) PID4.4.6 (NRI-Rez)	
4.5	Generate data and process understanding for phenomena that cannot be obtained from laboratory and verification of process upscaling.	Identification of hydrogeochemical key issues for the final site investigation analysis (Forsmark).	PID4.5.3 (GEOPOINT)	PID4.5.4 (HU) Will be delayed to M36

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
4.6	Development of upscaling procedures.	Quantification of heterogeneity-induced mixing and effective representation in a large scale reactive transport model.. Development of a chemistry module for reactive transport. Revison of different alternatives for upscaling transport.	PID4.6.6 (UPV)	
5.1	Quantification and characterisation of colloid content under variation of geochemical and physico-chemical conditions	Results from additional pumping tests and Eh-ph analyses have been evaluated and reasons for the increase of Eh-values in the northern part of the investigation area are discussed.	-	None
5.2	Determination of geochemical state of uranium and other trace elements in typical sedimentary systems in the far field of rock salt formations by use of advanced analytical methods	Combined scanning XRF and XRD investigations with micrometer resolution on Ruprechtov thin section sediment samples and statistical analysis of the µ-XRD data using unsupervised classification (USC) was performed. Analyses of $^{234}U/^{238}U$-ratios in different leachates from sequential extraction showed good correlation with results from U(IV)/U(VI)-separation. Activity ratios in step 1 and 2 reflect hexavalent uranium and those in step 4 and 5 reflect tetravalent uranium. Additional experiments to check if oxidation of part of U(IV) occurred during the U(IV)/U(VI)-separation method are under way.	PID5.2.6(3)	None
5.3	Provide information on the behavior of organic matter and on the geochemical behavior of uranium and other trace elements under natural conditions as expected in the far field of repositories in rock salt formations.	Further evaluation of data and modelling shows that microbial degradation of sedimentary organic matter in clay/lignite horizon takes place. SOC characterisation indicates that low DOC concentrations in the water of the clay/lignite horizon are due to the fact that humic acids form only a very small fraction of TOC, i.e. a very small fraction is accessible for extraction. Based on all information from RTDC2 and RTDC3 a scenario for uranium enrichment at Ruprechtov site is proposed.	PID5.3.2	None

WP	Objectives	Major **achievements** and decisions taken. If applicable, problems encountered and measures taken to solve the problems.	**PID's and Milestones** (due in the reporting period)	**Major problems / deviation from work schedule**
6.1	Monitoring of NF-PRO / RTDC 5 final reporting with the intention to extract information relevant for FUNMIG	Ongoing; Information will be used in the FUNMIG final reporting, namely near field – far field interactions and the safety relevant nuclides incl. their expected fluxes and concentrations at the boundary to the near-field.	-	None
6.2	To compile the current representation in PA of processes investigated within RTDC 1 – 5 and to develop a tool to evaluate the results of the latter with respect to their contributions to the safety cases of the individual European repository concepts.	The Task Evaluation Table for clay-rich and salt host rocks have been filled in. The last column of the tables has been adjusted to evaluate the results and is entitled 'Achieved improvements within FUNMIG'. It will distinguish between a 'Researcher's view' and a 'PA view'.	PID6.2.2	None
6.3	Establish database structure, introduce examples and submit to partners requesting input	Documents established and submitted to partners requesting input	PID6.1.3b	None
7.1	Keeping the website updated.	Job opportunities space has been introduced to the website Deliverables have been posted in the intranet	None	No
7.2	Preparation for the organization of the 3rd training course	On-going	None	No
7.3	Integration of communication issues with other projects/activities, with emphasis on science shop in collaboration with UPC	On-going	None	No

Table 5.1 (cont.): Detailed information on major problems / deviation from work schedule

Issue	Deviation, problem and measures taken
1	PID4.1.3: The reporting plans had to be changed due to insufficient resources. Delayed to M36
2	PID4.5.4: The reporting plans had to be changed due to insufficient resources. Delayed to M36
3	PID3.1.6: Delivered September 2007 instead of August.

6. Follow-up of 2nd Annual Project Review

The response to the 2nd Annual Project Review is documented in the 2nd Annual Project Report. There were some issues forwarded to the IMG, for their meeting, 25-26 June 2007 at the NAGRA's headquarters. These topics refer to recommendations No's 1, 2, 9 and 11. The outcome of that meeting was:

- External review of final reports associated with WP6.1 and 6.2 will be organized be the respective responsible organizations, i.e. ENRESA and NAGRA
- TET's for the clay case will be completed before the 3rd Annual Workshop, based on the TET's worked out for the Opalinus Clay by NAGRA. This will serve the basis for moving ahead with the TET's for the crystalline and salt host rock cases. It is foreseen that the TET's for salt and crystalline host rock cases become available and documented also in time for the forthcoming 3rd Annual Workshop or at the end of 2007.
- Inclusion of information concerning the progress in the scientific basis of processes treated within FUNMIG for application in the Safety Case will be done (i) through the IMG members, (ii) through self-assessment by researchers involved in the respective tasks, (iii) for processes along with their completion along with the Project, and will be (iv) documented within the WP6.2 related report. The information will subsequently be extracted for the final overall EUR report.

7. Consortium management

7.1 Closure of second project year

The 2nd Annual Project Report was delivered on time. Prior to the 2nd Annual project Review, some complementary information and missing reports were provided. Request for acceptance of the 2nd project year reporting was sent to the Commission, the request dated 11 June 2007. The request was associated with amendment by inclusion of the 3rd 18 Months Implementation Plan. A final submission of a Cost Statement took place 20 June. The reports, Cost Statements (and Audit Certificates, as appropriate) and the request to accept the reporting, is the prerequisite for moving on with the 3rd Advance Payment.

Few Contractors have not managed to provide the required reporting, including the Annual Cost Statements, and thus will be excluded form the 3rd Advance Payment. If reporting is complemented, the Advance Payment can take place in the forthcoming project year.

Closure of the participation of Contractor No. 36 (TUM-RCM) is still pending.

7.2 Associated Groups

The number of Associated Groups has increased steadily (presently 28 organizations). For the Associated Groups, the Project serves as a general source of information on relevant on-going activities. In addition, the project is a source of information concerning relevant FP6 and forthcoming FP7 activities. For the Project, the Associated Groups are an asset with respect to, for example involvement in the R&D program and identification of training needs. Efforts will continue towards stronger involvement of the Associated Groups, reflecting the different interests of the different organizations.

7.3 Preparing for the 3rd Annual Project Workshop

NIREX/NDA has accepted to host the 3rd Annual Project Workshop. It will, take place in Edinburgh, 26-29 November 2007. Negotiations with the conference hotel etc. are in an advanced state. Only minor practical details are pending. The general Agenda has been defined. Following recommendations of the 2nd Annual project Review and evaluation of participant information from the 2nd Annual Project Workshop, changes relative to previous Annual Workshops are especially, (i) less overlap between RTDC meetings, and (ii) two evening poster sessions. The host (NIREX/NDA) has accepted to print the 3rd Annual Workshop Proceedings as a NIRX/NDA report.

Creation of awareness of the forthcoming workshop within and beyond the Project is done over several channels. Potential participants beyond the Project partners are reminded that the workshop welcomes external participation. Spreading of the information is based especially on distribution of flyers (electronic and hard-copy) to all Project Partners and information at several conferences and international/national workshops and meetings.

7.4 Preparing for the 4th and final Annual Project Workshop

The 4th and final Annual Workshop will take place in Karlsruhe, 24-27 November 2008, hosted by FZK-INE. The Annual Workshop is planned to take place in “AkademieHotel”, few minutes by commuter train from the Karlsruhe main railway station, where all facilities including hotel rooms are available on-site.

7.5 2nd Annual Workshop Proceedings

The external review of S+T contributions to the 1st and 2nd Annual Project Workshop Proceedings proved to be very successful. Budhi Sagar (SWRI) will be addressed for being S+T reviewer also at the 3rd Annual Workshop. Decision on the second person to be addressed for the S+T review is still pending.

7.6 Planning for future training activities

Training includes a broad range of activities, reaching from individual training-on-the-job measures to training courses addressing a broader target group. In Euratom FP7, training will focus on flexible training activities conducted within projects. Future planning for training activities within the present project is guided by the desire for effective individually tailored training-on.-the-job, integration of training with other relevant projects (recommendation within 2nd Annual Project Review), making effective use of resources, and finally allow for support of potential trainees that in the past have regretted not having been ablbe to participate because of there own limited resources. For these reasons, individual training measures, especially through NoE ACTINET mobility measures are continued. With respect to integration of training with other relevant project, making efficient use of resources and the lack in support through the SA KNOWDISS with its aim of integrating training by cross-project training courses, a proposal is forwarded to the GovBoard.

The proposal is to organize one training course during the final project year in collaboration with IP PAMINA with focus on the application of the scientific-technical project outcome for the Safety Case. Such a joint training course (i) reflects the training objectives towards the end of FUNMIG, the intersection with and objectives of PAMINA, (ii) makes efficient use of resources, and (iii) allows for adequate support for trainees that have a strong interest in the training but do not have sufficient own resources for participation.

This approach will be implemented, pending acceptance by the GovBoard.

7.7 Main meetings held

Meetings below RTDC level are not reported. RTDC meetings for the relevant reporting period partly fall outside the project months 13-18:

- Meeting between the Coordination Team and the Commission, in preparation of the 1st Project year reporting, Brussels 8 February
- ExCom meeting, Brussels 19 March
- Project Review, Brussels 20 March
- RTDC-1 meeting, Loughborough 11-13 June

- RTDC-2 meeting, Munich 26 August
- RTDC-3 meeting, Paris/Bure 12-13 June
- RTDC 4 meeting, Madrid 27 June
- RTDC 5 meeting, scheduled for end of September in Berlin
- IMG meeting, 25-26 June

Annex: Use and dissemination

Use and dissemination is mainly related to communicating the project and its outcome to

(i) direct end-users,

(ii) involved and interested research organizations, and

(iii) a broader interested community.

Direct end-users are mainly implementers and regulatory bodies. These end-users from the EU are involved in the project or have been invited to participate. This ensures that interested end-users are informed and can make use of the project outcome. Extension of the Associated Groups by additional direct end-users contributes to dissemination of the Project outcome.

Use of the project outcome within the research community beyond the Consortium is given by publication of the annual project workshop proceedings and publications in the open literature. In addition, involvement and communication with organizations from a broad set of European countries, also those with small nuclear programs and/or a low competence level, is important for the possibility of their use of the project outcome. Additional Associated Groups in the form of research oriented organizations is a key in broadening the direct dissemination of the project outcome to the research community. This is also very true for organizations from new member states.

A broader scientific-technical community is addressed by close cooperation, especially with IP NF-PRO and IP PAMINA. Representatives of these two projects are invited to present at the forthcoming 3rd Annual Project Workshop.

A broader interested community is addressed by alignment of project activities with projects where such groups/organizations are involved. One example of involvement promoting such dissemination of the project outcome is the participation with presentation of the OBRA project (Observatory for Spent Fuel Governance) at the 2nd annual workshop.

The project is communicated to a broader interested community. During the first two project years, articles were published in the European Parliament Magazine. During the present reporting period, the Project has been presented in ATW (Atomwirtschaft), June 2007.