

# ReCosy News

## Redox Phenomena Controlling Systems



Newsletter, June 2010

### In this issue

- 1 Introducing ReCosy
- 1 4<sup>th</sup> Semi-Annual Newsletter
- 2 EDITORIAL
- 2 Main areas of research
- 3 RESEARCH (WP1 to WP6)
- 8 KNOWLEDGE MANAGEMENT  
AND TRAINING
- 9 EVENTS
- 10 RECOSY PARTNERS

### Introducing RECOSY

RECOY is a four year (2008-2012) Collaborative Project under the Seventh Framework Programme of the European Atomic Energy Community (EURATOM) starting on 1<sup>st</sup> April 2008. To this aim, the project set up a consortium of 32 Contractors and presently 6 Associated Groups. The consortium includes key European Research Institutes, Universities, National Waste Management Agencies and SMEs from 13 EURATOM signatory states, Russia, Japan, Korea, USA and one European Joint Research Centre.

The redox phenomena controlling systems is not a new geochemical issue. Nevertheless, there are still topics where improved understanding can further contribute to acceptance of the Safety Case. These questions are related to, amongst others, redox processes in the long-term dissolution/chemical transformation of the radioactive waste, waste packages and engineered barriers, and migration in the far-field, including which species are formed and their respective various retention mechanisms

The key objectives of ReCosy are to provide for (i) a better determination of the system redox conditions, (ii) understanding of relevant redox processes, and (iii) impact of these processes on the disposal Safety Case. For this purpose scientific and technical objectives cover the understanding of redox buffer capacities, redox kinetics and the long-term redox evolution and the relevance of the redox impact on the radionuclide transport.

Coordinator: Gunnar Buckau (Karlsruhe Institut of Technology)

Scientific-Technical Secretariat: Lara Duro (Amphos 21) and Vanessa Montoya (Amphos 21)

### Website RECOY:

<http://www.recosy.eu>

### Newsletter submitting organization:

Amphos 21

Passeig Garcia i Fària  
49-51

E08019 Barcelona  
Spain

### 4<sup>th</sup> Semi-Annual Newsletter

The main purpose of the Semi-Annual Newsletter is to inform the broader community on the progress research carried out by the RECOY project. The present Newsletter gives a brief overview of the project activities and progress during the project months 22-26 (February 2010- June 2010). It is made available at the public project web page ([www.ReCosy.eu](http://www.ReCosy.eu)). It is also distributed by email to a list of recipients. It is furthermore encouraged to use printouts at different events such as workshops, meetings and conferences in order to inform potentially interested persons.

This Semi-Annual Newsletter is less detailed than the 2<sup>nd</sup> Annual Project Activity and Management Report, used for thorough information of project partners, the Commission and project reviewers



## EDITORIAL

Dear Reader,

I have the pleasure to present the fourth issue of the RECOSY Newsletter. With this Newsletter, we would like to inform a wider audience on RECOSY's activities. RECOSY is a four year (2008-2012) Collaborative Project under the Seventh Framework Programme of the European Atomic Energy Community (EURATOM) dealing with research on the geological disposal of radioactive waste including Phenomenology and Performance Assessment studies.

The Coordinator is the Karlsruhe Institute of Technology (KIT), Germany. The Coordination Team (CT) consists of two organizations, namely KIT-INE and Amphos 21. In addition to work program planning and project management, the CT is also implementing activities on training and education, and management and dissemination of knowledge. The Executive Committee (ExCom) consists of the WP leaders, ensuring adequate operation of the overall project.

The End-User Consultancy Group (EUCG) is established with three representatives from Waste Management Organizations and three organizations with National Regulatory Functions. It advises in view of ensuring usefulness of the project work for application to the disposal Safety Case and review of scientific-technical reporting in this respect.

The project is open for additional organizations entering into formal cooperation and participation via Associated Group agreement.

The key objectives of ReCosy are to provide an improved interpretation of redox potential in all relevant host-rock systems to be used within European Safety Cases. In this and the coming issues of the RECOSY Newsletter, we will inform you on major research topics and highlights from the project. I hope you will enjoy reading and welcome your feedback!

Mireia Grivé (info@recosy.eu)

Knowledge Management and Training RECOSY- Officer

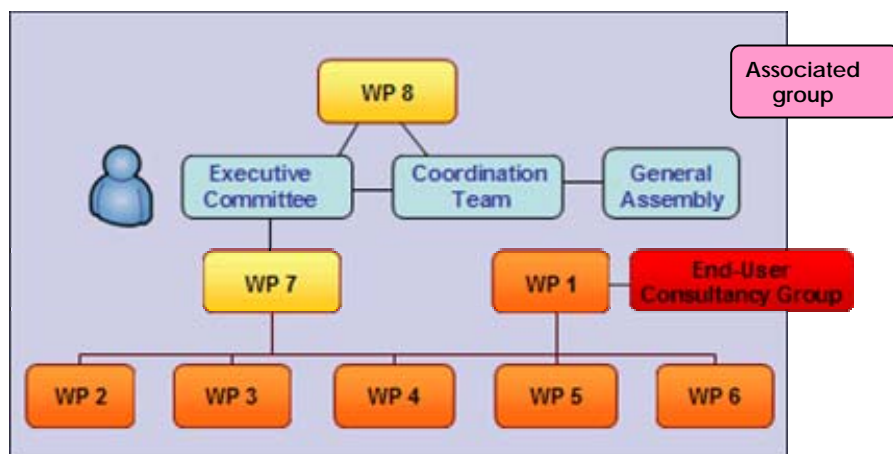
---

*The project is OPEN for additional organizations entering into formal cooperation and participation via Associated Group agreement.*

---

## Recosy's main areas of research

The scientific-technical work program is structured along six Research Technological Development workpackages (WP1-6). They cover near-field and far-field aspects as well as relevant host-rocks considered in Europe.



RECOSY organization

WP 1 deals with documentation on the overall project outcome for its implementation in the Safety Case. WP2 focuses on development of redox determination methods. WP3 focuses on redox response of defined and near-natural systems. WP4 studies the redox reactions of radionuclides. WP5 focuses on redox processes in radionuclide transport and WP6 deals with the redox reactions affecting the spent fuel source-term. Specific workpackages on knowledge management, education and training (WP7) and administrative management issues (WP8) are also included in the project.

## RESEARCH

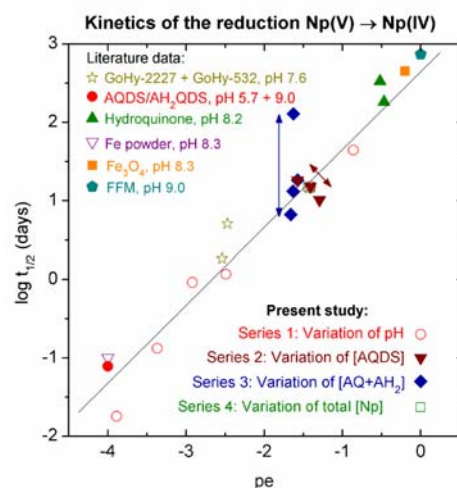
### Research on Development of redox determination methods (WP2)

The objective of WP2 is the development and testing of redox determination methods using different type of electrodes as well as optodes (optical sensors) in order to provide a broad and solid scientific-technical basis for the application of such. In combination with chemical analysis and associated thermodynamic modelling the redox state of systems (relevant for nuclear waste repositories) is assessed. The overall goals are (i) to develop redox determination methods specifically designed for environmental applications, and (ii) a broader information base for interpretation of system conditions.

The first point reflects the limitations of existing determination methods and models (and new developments) due to poisoning of electrode material, diffusion potentials in electrode bridges, drift through catalytic reactions on electrode material, drift through changes in electrolytes via diffusion, analytical difficulties in determining concentrations of redox sensitive system components or state of involved solids/minerals, and insufficient/inadequate thermodynamic data for calculation of the redox state.

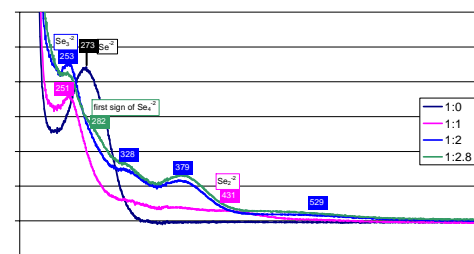
In this context the different participants of this workpackage are working on different issues. KIT-INE continued the investigation of Np(V) reduction at different pH and pe conditions in homogenous and heterogeneous systems with inorganic and organic reductants. ARMINES continued in the development of a methodology for redox determination in hyperalkaline systems based on Se speciation. One of the major objectives in 2009/2010 for BRGM was to carry out robust geochemical (Eh-pH) sensor concepts being able to be devoted (after adaptation or development and/or implementation) to the observation and monitoring of the underground components of a nuclear waste storage. Measurement of redox potential (Eh) and dissolved oxygen ( $O_2$ ) concentration by microsensors (Clark type) in biofilm samples grown in the laboratory and in acidic waters of a uranium mine where studied by FZD. In the last year the GRS continued the development of two methods for redox potential determination in saline media and tested them on solutions with low and high ionic strength. Examination of the changes of Eh, pH values of the binary (iodine species-kaolinite) and ternary systems (iodine species-kaolinite-humic acid) is studied by TUG. Main work performed by UPPC are a) further Miniaturization of sensing components (optoelectronics, filters, optics, fiber tip etc.) b) Evaluation of fluorescence probes and novel polymer matrices for fiber-based chemical sensing applications, c) Oxygen measurements in real-world biofilm samples d) Improvement of oxygen determination. Finally, contribution of LQC was essentially advisory to various other partners on issue in which the principal investigator in LQC has direct experience.

**WP leader: Dr. Michael Kumke (University of Postdam, Physical Chemistry)**



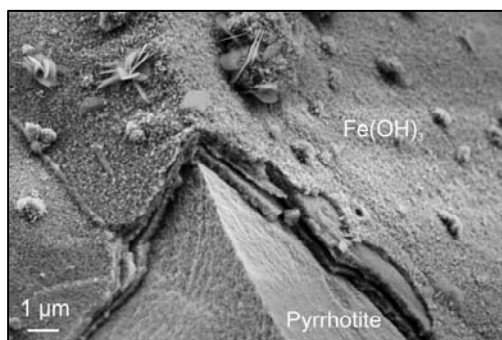
Dependence of the half-life ( $\log t_{1/2}$ ) of Np(V) reduction on the redox potential  $pe$ .

*Development of two methods for redox potential determination in saline media is being investigated in RECOSY*



UV-Vis analyses of Se speciation in 4 M KOH under reducing conditions.

## Research on Redox response of defined and near-natural systems (WP3)



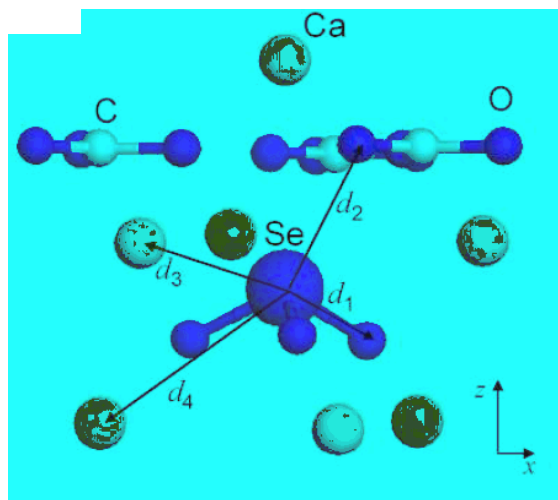
*Fe(OH)<sub>3</sub> layers precipitated on pyrrhotite surface (Arcos et al., submitted)*

The objective of WP3 is to quantify and develop process understanding for redox buffer capacity and kinetics of response to redox perturbations of defined and near-natural systems. This includes, determination of key electrochemical parameters of electrodes as well as redox response of defined and near-natural systems to redox disturbance, namely (i) finely ground Callovo Oxfordian materials, ii) ions naturally present in the porewater (e.g.  $H^+$ ,  $SO_4^{2-}$ ,  $HS^-$ ,  $Fe^{2+}$ ), iii) redox sensitive radionuclides analogues (e.g. Se(VI), Se(IV), I<sup>-</sup>,  $CH_4$  for  $^{14}C$ ) and iv) gases ( $O_2$ ,  $CO_2$ ,  $H_2$ ,  $H_2S$ ), in different situations, both similar to the expected natural situations and to very perturbed conditions.

In the second year of the project, the WP3 work have been focused on (i) Field data, (ii) Field samples, (iii) Microbiology, (iv) Sorption experiments, (v) Redox experiments and (vi) Conceptual Modeling.

KIT-INE has worked on spectroscopic characterization of the natural organic matter from the Callovo- Oxfordian formation and the Opalinus Clay. Other work includes uranium redox speciation by 3D confocal  $\mu$ -EXAFS,  $\mu$ XRD and  $\mu$ STXM in clay-rich samples from the Lodève basin (France). Sorptive reduction of U(VI) on magnetite nanoparticles have also been studied by KIT-INE. BRGM have investigated the electrochemical behavior of the previously made electrodes with the presence of different key redox couple(s) like Fe(II)/Fe(III), S(-II)/S(VI), H(I)/H(0), N(-III)/N(V). CTM and AMPHOS have continued investigating the reducing capacity of natural pyrrhotite through thermodynamic and kinetic experiments. TUG works on the analytical measurements of iodine concentration. The immobilization by calcite of Fe(II) (to be released by canister corrosion) and Se(IV) (to be released as  $^{79}Se$ ) has been investigated by CNRS. GEOPOINT deliveries of real data from the Swedish site investigation to UNIZAR and UNIZAR investigate the Swedish granite system groundwaters through thermodynamic equilibrium computations. II-HAS investigated the response of Boda Claystone samples for redox disturbances by equilibrating the samples with different redox couples providing stable potential conditions and determining the change of  $Fe^{2+}/Fe^{3+}$  ratio in the respective minerals afterwards. During the second year of the project UCYPURUS has collected phosphogypsum samples from different areas of the phosphogypsum stack at a coastal area in Cyprus in order to estimate the redox potential from the  $[S(II)]/[S(VI)]$  ratio. MICANS has done 20 boreholes in the underground Aspö laboratory and study the influence sulphate reducing bacteria. UNIUTR Compares the behavior of hematite with that of lepidocrocite regarding the coupling of redox processes in systems containing Fe(III)/S(-II)/U(VI).

**WP leader: Dr. Laurent Charlet (Centre National de la Recherche Scientifique)**



*Local structure around a Se(IV) atom in calcite, resulting from the VASP simulations (Aurelio et al., 2009)*

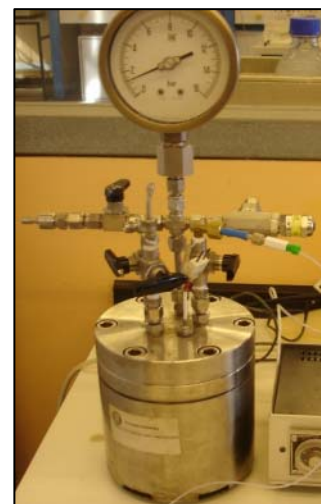
## Research on redox reactions of radionuclides (WP4)

The goal of the activities within this workpackage is to provide fundamental process understanding of the redox behaviour of radionuclides, including the question of equilibrium / disequilibrium with the system redox conditions. The objectives of this work package result from gaps in the knowledge identified from previous projects dealing with redox processes involving radionuclides

The activities within can broadly be divided in four main topics: 1) Interactions of radionuclides with pyrite 2) Interactions of radionuclides with far-field solids 3) Redox processes under hyperalkaline conditions 4) Redox behaviour under microbial processes.

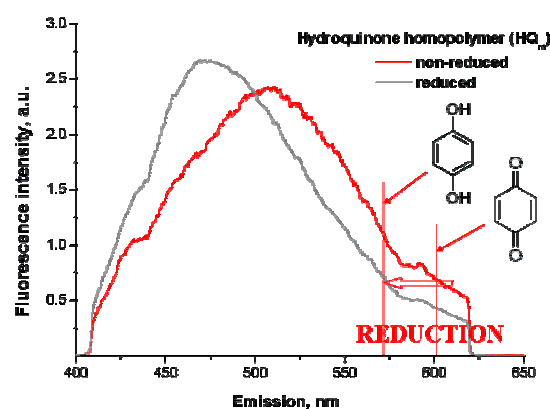
CTH investigate redox reactions and states of selected redox sensitive elements with relevance to a crystalline rock environment (Äspö, Sweden). UMANCH is investigating the interactions between surfaces, humic acids (HA) and redox sensitive radionuclides in ternary systems, with the aim of predicting radionuclide chemistry and solid/solution partition. IPL studies the sorption of Pu to natural clays with naturally present iron oxide coatings. Samples of Triassic clay from a site mined for industrial exploitation known as the Šaltiškiiai (North Lithuania) quarry were taken for laboratory investigations. KIT-INE has worked on three different research topics. a) batch-type experiment with Opalinus clay and Callovo-Oxfordian argillite on Tc(VII), Np(V) and Pu(V), b) sorption/ sorptive reduction kinetics of Np(V), Tc(VII) and U(VI) on fracture filling material (FFM) from the Äspö granite and Grimsel granodiorite c) following the training activity of Dr. Natalia Shcherbina (MSU), carbon XANES analysis of Mayak sediments and isolated humic colloids from Lake Yrtyash and different hydroquinone enriched humic substances that were investigated at the soft X-ray spectromicroscopic beamline X1A at the National Synchrotron Light Source (NSLS), Brookhaven National Lab. (BNL) has been evaluated. ULOUGH has performed experiments to investigate the complexation of Tc(IV) with 4 anthropogenic ligands, EDTA, NTA, ISA and picolinic acid. AMPHOS aims to provide an understanding of redox behaviour of the uranium system under hyperalkaline conditions. The contribution of PSI to WP4 is focused on the influence of redox conditions on the immobilization of Neptunium in highly alkaline cementitious environments

Some of the participating institutes are focusing their work on the study of the microbial impact (IPL) and on the oxygen concentration and uranium redox state in-situ in biofilms with emphasis on biologically mediated redox processes (FZD). The studies are carried out on isolated microorganisms as well as on biofilms. Biofilms are composed of bacteria, fungi, algae, protozoa, exopolymeric substances (EPS), corrosion products and 50–95% water. They are ubiquitous and have to be considered as an important factor in natural biogeochemical processes influencing the redox state of radionuclides. They show a multiplicity of interactions with metals and contribute to metal mobility or immobilization. FZD focus on biologically mediated redox processes of in-situ biofilms growing in a uranium mine in Saxony (Germany), which is currently in the process of being remediated. The scientific activities of IPL comprised the effect of microorganisms on plutonium oxidation states



*Autoclave used to perform the batch experiments.*

*Impact of Microorganisms from clay and groundwater samples will be studied*



*Fluorescence peak positions for the oxidized and reduced forms of the hydroquinone homopolymer (Shcherbina et al. submitted)*



## Research on Redox processes in radionuclide transport (WP5)

The goal of the activities within this work package is to study the behavior of redox-active radionuclides Tc, Np, U, Pu, I and Se with the aim to determine the redox impact on their transport through crystalline rocks, clay rocks and contaminated systems.

Investigations are made in different redox media that can be met around planned waste repositories. Radionuclide behaviour is studied in diffusion and sorption experiments, retrospectively using observations of radionuclide retardation under different natural conditions. An important question is "do the redox-reactions play a role in radionuclide retardation?". The answer is searched for in this WP by studying the redox-state of retarded or immobilized radionuclides. This work is done with the help of modelling and laboratory experiments, using various spectroscopic techniques and wet chemistry. Complementary, investigations in situ at the planned repository site in Finland (Olkiluoto), around a phosphogypsum stack at the Vasilikos site in Cyprus and in a contaminated site in Mayak, Russia are also performed within this workpackage.

KIT-INE continued batch-type experiments on the sorption/sorptive reduction kinetics of Tc(VII), Np(V) and Pu(IV) in the presence of fracture filling material. The Äspö granite and Grimsel granodiorite were used as sample material. KIT-INE has collaborated with MSU in characterizing humic substances isolated from Mayak sediments and Lake Yrtyash humic colloids. CEA continued investigations on the behaviour of U(VI) and long-lived redox active fission products Se(IV,VI) and I(-I,V) in contact with Callovo-Oxfordian (COx) argillite samples. The redox-activity of the sample material was deduced from the presence of  $\text{FeS}_2/\text{FeOOH}/\text{FeCO}_3$  buffer. UH continued investigations on in situ behaviour of uranium by examining U series disequilibrium on fracture surfaces in order to identify U retardation or accumulation and developing a wet chemical method to study the redox-state of U accumulated on fracture surfaces. Fracture surface samples are from the groundwater infiltration area at the Olkiluoto study site. II-HAS is investigating the reduction driven retention of I, Tc and U in a redox gradient in clay rock. UCYPUS continued investigations to assess the impact of redox conditions on the stability of the phosphogypsum stack (e.g sulphate reduction) and U(VI). Samples have been collected directly from the phosphogypsum stack and from fluids from three different sub-areas of the phosphogypsum stack. MSU has investigated actinide speciation in samples collected at contaminated sites in Russia in order to verify the experimental data obtained under well-defined laboratory conditions. The methods included (1) redox speciation of actinides by spectroscopic methods (XPS, XAFS) and membrane extraction, (2) study of possibility for the formation of An(IV) eigencolloids by alpha track analysis, TEM, STEM-HAADF, EELS and XAFS,...and (3) study of preferential binding of actinides to different colloids by nano-SIMS and the actinide redox speciation by membrane extraction

The status of the investigations was presented by the partners in the 2<sup>nd</sup> ReCoSy AWS in Larnaca, Cyprus.

**WP leader: Dr. Juhani Suksi (University of Helsinki)**



*Core material of the Callovo-Oxfordian (EST30471) observed in anoxic glove box prior conditioning*



*Opening of the vacuum sealed samples in N<sub>2</sub> glovebox in the laboratory of radiochemistry, University of Helsinki*

## Research on Redox reactions affecting the spent fuel source-term (WP6)

The source term from spent fuel dissolution is subject to considerable uncertainties, both with respect to the presence and extent of oxidative dissolution processes of the spent fuel itself and the coupling with processes associated with the iron canister. Related problems to be examined in this work package are the representativeness and reliability of laboratory data with respect to the impact of unavoidable minor concentrations of oxygen also in inert-gas boxes used, the potential reactivity and impact of hydrogen from container corrosion in combination with high burn-up spent fuel, possible galvanic coupling of spent fuel and container material and the retention of redox sensitive radionuclides by relevant minerals, especially by steel container corrosion products.

A set of investigations has been conducted with the aim of getting better insight into redox processes determining spent fuel and iron canister corrosion. JRC-ITU is reporting on studies on spent fuel in presence of corroding Fe and on thin film model systems, and on corrosion of spent fuel in presence of  $H_2$  and on fuel corrosion studies on thin film model systems. Effects of  $Y_2O_3$  doping on the redox reactivity of  $UO_2$  have been studied at KTH. The reductive trapping of actinides in container corrosion products during spent fuel corrosion is investigated by KIT-INE. Studsvik reports on advances in the reductive immobilization of  $^{237}Np$  on iron canister material under repository conditions. Following change in access to competence because of the temporary leave of a responsible scientist, part of the work program is refurbished. Emphasis is given to investigations on the hydrogen catalytic effect of SIMFUEL by D/H isotope exchange method. The effect of iron corrosion on redox potential was studied by NRI.

**WP leader: Dr. Detlef Wegen (Joint Research Centre- Institute for Transuranium elements)**

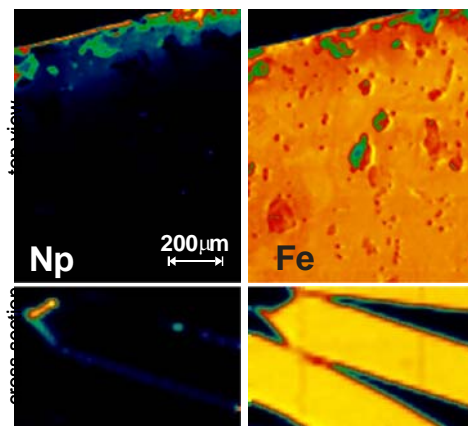
## HARMONIZATION OF WORK PROGRAM AND IMPLICATIONS OF REDOX FOR THE SAFETY CASE (WP1)

One of the objectives of this workpackage is the harmonization of the work program and to show the relevance of the redox processes in the Safety Case. To this aim, the safety case that was selected from the beginning of the project was that for the ANDRA B2 cell. The medium activity long lived waste at ANDRA is the B2 waste, which is a result of the treatment of radionuclides with compounds such as nitrate and sulphate and high content of bitumen. The outcome of this treatment is a waste presenting nitric acid and generally oxidising conditions. This can affect the mobility of radionuclides.

One of the main issues of concern is how the oxidising conditions developed within this type of cells might affect the mobility of radionuclides.

Hence, the redox processes play an important role in the safety case of the B-type wastes. According to the modelling results of the release of nitrate from this type of cells, very high concentrations can be achieved in the vicinity of the wastes, and  $H_2$  gas generation is also predicted to occur. Redox processes are, thus, very relevant for the understanding of the evolution of these materials.

**WP leader: Dr. Lara Duro (Amphos 21)**

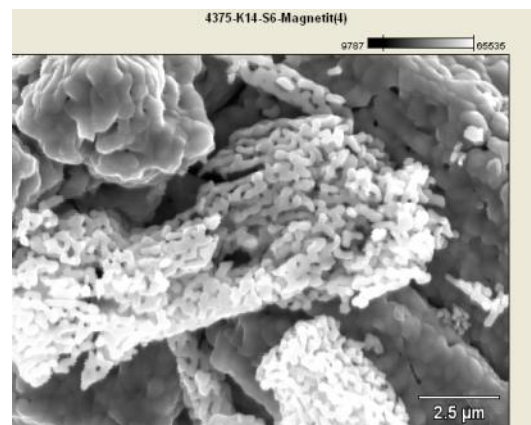


*Results of  $\mu$ -XRF analysis of a representative polished iron sample*

---

*$Y_2O_3$  doped  $UO_2$  pellets are significantly less reactive towards  $H_2O_2$  than pure  $UO_2$  pellets*

---



*SEM micrographs of magnetite agglomerations recovered after termination of the experiment with U contents around 0.5 at%.*

## KNOWLEDGE MANAGEMENT AND TRAINING (WP7)

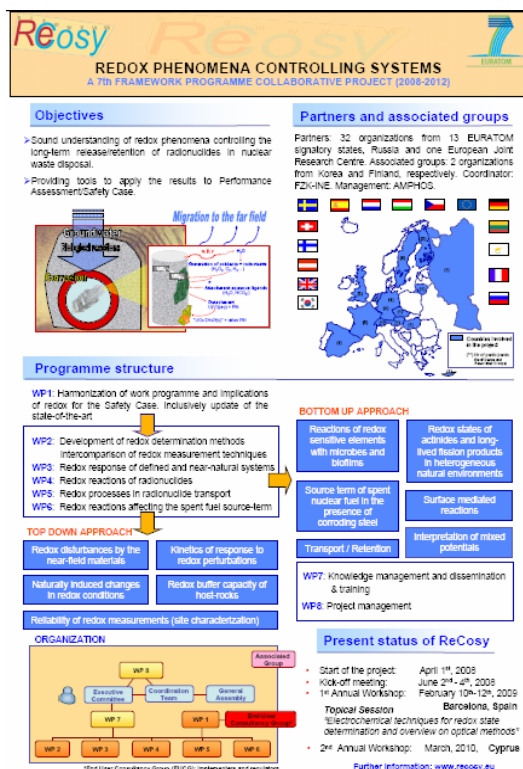
The WP 7 addresses the internal and external training as well as knowledge management for the RECOSY project.

A public web site was established within the project ([www.recosy.eu](http://www.recosy.eu)). At this site, information about the project and the project activities are made available to the broad community. A project internal Intranet site has been established where non-public documents and reports are kept.

The generic poster has been presented at different occasions, including Euradwaste'08, 20-23 October 2008 in Luxembourg, Migration'09 and ICEM 2009.

The Annual Project Workshops are important elements in the documentation and dissemination of the project outcome. The Annual Project Workshop Proceedings are comprehensive public reports with the key scientific-technical outcome. Proceedings with the scientific-technical outcome of the first project year are published as report FZKA 7466 and the second annual proceedings are in preparation.

Dissemination of more detailed results are done through scientific journal papers, books, reports, proceedings of various conferences and workshops, PhD thesis, etc. Presentations at different occasions of detailed project work and results or the overall project is also a key contributor to dissemination. The dissemination of the project is impressive (19 scientific journal papers, 2 technical reports, oral presentations and posters at 35 international occasions in Europe, Japan, USA, Canada and Russia)



*First training measure has been finalized and deadline for request for additional training mobility measures is end of July 2010.*

TRAINING resources will be used for training-on-the-job of young researchers by project internal mobility measures. The measures are aiming for a maximum period of about three months where travel costs for the stay at another organization (or organizations) are covered. Partners or Associated groups need to apply through the Coordination Team for such training measures.

**Natalia Shcherbina, MSU**, implemented the first training and mobility measure. Within the measure, she was visiting KIT-INE, UPPC and Brookhaven National Lab. The focus of work was the nature of the redox state in dissolved natural organic substances. Laser-induced time resolved fluorescence spectroscopy (TRLFS) and Synchrotron radiation based spectroscopy (XAS) were used in order to characterize the chemical and functional properties of the humic substances in relation to their redox state. Ms. Shcherbina is now working with partitioning ligands at PSI. The contact for this work was established within the training and mobility measure.

**WP leader: Dr. Mireia Grivé (Amphos 21)**





## EVENTS

### RECOSY 2<sup>nd</sup> Annual Workshop (16<sup>th</sup>-19<sup>th</sup> March 2010, Larnaca)

The 2<sup>nd</sup> Annual Project Workshop was held in Larnaca, Cyprus (16<sup>th</sup> to 19<sup>th</sup> March 2010) hosted by Cyprus University. In association with this event, meetings of the different project consortium bodies (Executive Committee, General Assembly, End-User Consultancy Group) also took place.

In total 65 persons attended, including: beneficiaries partners (27 out of 32 partners involved in the project), associated groups (BGS, STUK and LANL), EUCG's members, external participants (NIS and NDA from Italy and UK, respectively) and the European Commission project officer, Christophe Davies.

The main purpose of the Workshop was to communicate and discuss the scientific-technical outcome of the first project year in the form of oral presentations around the project, two poster sessions, and the topical session. Next to an overview of the achievements within the respective WP, scientific highlights were presented (30).

During the workshop a specific Topical Session focused on Redox determination by thermodynamic methods and associated Thermodynamic Databases and the application to Performance Assessment/Safety Case was organized by KIT-INE and AMPHOS.

The scientific-technical outcome of the second project year is documented, reviewed by the EUCG and disseminated in the form of workshop proceedings (KIT report, in preparation).

### RECOSY 3<sup>rd</sup> Annual Workshop (to be held 22<sup>nd</sup> -25<sup>th</sup> March 2010, France)

The 3<sup>rd</sup> Annual Project Workshop (AWS) is under preparation. It will be held in France 22<sup>th</sup> to 25<sup>th</sup> March 2011, organized by Bernard Grambow and Laurent Charlet.

This third annual workshop, like the former ones, gives the project internal and external participants an insight into the project, its activities, status and achievements. It also provides decisions and communication of the planning for the fourth and final project year. Meetings of the Executive Committee, the General Assembly and the End-User Consultancy Group will be held within the context of the Workshop. This third Workshop will have more panel presentations and discussions across the different project workpackages.

This reflects that the administrative, agreement and planning issues that are very important at the first annual workshops, now is giving way for more in-depth R&D work and developments. The Topical Session will be entitled "Redox, surfaces, disequilibrium, gas phases, kinetics.... " It will be jointly organized by Bern Grambow and Laurent Charlet. Poster sessions will be held where the progress in work and joint project activities should be reflected in multi-partner presentations. The flyer with the main information about the workshop will be distributed among the project partners and uploaded to the internet website, accessible for any interested party ([www. ReCosy.eu](http://www.ReCosy.eu)).



*RECOSY 2<sup>nd</sup> Annual Workshop (16<sup>th</sup>-19<sup>th</sup> March 2010), Larnaca*



*RECOSY 2<sup>nd</sup> Annual Workshop (16<sup>th</sup>-19<sup>th</sup> March 2010), Larnaca*

---

*Electronic brochure  
informing on the 3<sup>rd</sup>  
Annual Workshop will  
be available in the  
RECOSY WEB page*

---

## InterComparison Exercise on determination of system redox state (16<sup>th</sup>-20<sup>th</sup> November 2009, Karlsruhe)

The InterComparison Exercise (ICE) took place in Karlsruhe 16<sup>th</sup> -20<sup>th</sup> November 2009, hosted by KIT-INE, Karlsruhe, Germany. The outcome and future actions were discussed during the 2<sup>nd</sup> Annual Project Workshop. The ICE was considered a great success, not necessarily solving all associated problems, but helping in creating the required problem awareness and in defining next steps.

The aim of this Exercise was the Assessment of inter-laboratory comparison with the different existing and the new developed methods for redox determination, including comparison of different protocols used by different research groups. The impact is that trust is provided in the capability to adequately determine the system redox state as a prerequisite for adequate regard of redox within the Safety Case. The ICE used samples covering different types of redox systems and reflecting typical geochemical boundary conditions including, among others, systems with organics, or with high ionic strength, under hyperalkaline conditions, or with microbial activity.

Within the exercise, electrochemical redox determination methods are compared in view of applicability and limitations for different systems and purposes, Emphasis is on static measurements with electrodes, complemented by dynamic/transient and amperometric methods, as well as one group using optodes. A set of designed and near-natural samples was used for the comparison of methods. The preliminary outcome of the ICE shows the necessity of the exercise, i.e. underlines inconsistencies between different approaches, but also between different groups presumably using the same approaches. There is a need for detailed evaluation in order to draw conclusions concerning the outcome, and further activities will be decided upon based on the detailed evaluation. The present status is that a comprehensive report is scheduled for end of June 2010

## Key event schedule

Below are given key events of RECOSY project that are open to external participation.

### 3<sup>rd</sup> Annual Project Workshop

22<sup>nd</sup>-25<sup>th</sup> March 2011, France

### Final Annual Project Workshop

February/March 2012, Karlsruhe, Germany

MARCH 2011						
Mo	Tu	We	Th	Fr	Sa	Su
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

## RECOSY PARTNERS

