

## NEWSLETTER N°6

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### BREAKING NEWS



#### Annual Event n°2 – 28<sup>th</sup> to 30<sup>th</sup> March 2022

Save the date for EURAD second annual event that will take place in France at IRSN (Fontenay-Aux-Roses).

'What did we learn up until now and how can the value of this new knowledge be maximized using EURAD's KM systems. Furthermore, what additional work is foreseen in the remainder of EURAD-1 to achieve the desired step change in European collaboration towards safe radioactive waste management?'

## PORTRAIT

### EURAD Project Officer

Seif has worked for more than 12 years in the decommissioning and the radioactive waste management field. He graduated from Ecole des Mines de Paris in France in 2009 and obtained his PhD in Civil Engineering on the development of a decontamination process for radioactive concrete structures in 2012.

The PhD was a tripartite collaboration of the CEA of Marcoule, the Université of Toulouse and the French company Bouygues Construction. He then did an 18-month postdoctoral fellowship at the IRSN, the French TSO, in Fontenay-aux-Roses on the modelling of two-phase flows in clay formations using Lattice-Boltzmann models. From 2015, he has worked for 6 years in the RD&D department of the Belgian WMO, ONDRAF/NIRAS.

The scope of his duties included the disposability assessment of conditioned radioactive waste, the development of cementation processes for radioactive waste streams and research projects related to the behavior of the EBS in a deep geological repository. In January 2021, Seif has joined the Euratom unit of the Directorate General Research and Innovation at the European Commission as a Policy and Scientific Programme Officer. He has been since then the new Project Officer of EURAD.



"I have only recently joined the European Commission and it has been a great honor and responsibility to be part of the EURAD family. The European Joint Programme on Radioactive Waste Management has delivered exceptional results with significant immediate or potential impact. Although these past two years, the COVID-19 pandemic context has significantly affected the implementation of the work plan, EURAD has and is delivering high quality results that would benefit the whole community. These are the first steps of a formidable opportunity so that we collectively set a new collaborative way of doing research and sharing knowledge between not only countries but also generations. I am looking forward to finally having my first interactions in person with the EURAD community."

## A LOOK BACK

### ConCorD has launched !

In early June the activities of WP ConCorD were launched through seven individual online kick-off meetings. These covered the 6 Tasks of ConCorD (Management, Novel canister materials, Corrosion under irradiation, Microbial effects on corrosion, Corrosion during nearfield transients, and Integration) and the Expert Review Group (ERG). The meetings were primarily aimed at coordinating planned activities and defining modes of collaboration and exchange. The Task meetings were coordinated by the Task Leaders, and each Task participant had the chance to present their plans and provide feedback. The Task meetings were open to all, and on several occasions interactions between Tasks were identified and connections were established.

Of particular interest was the participation of members of the Expert Review Group, which is specific to WP ConCorD, in the Task meetings. The ERG consists of 9 international experts with the mandate of steering the programme and ensuring scientific excellence. This will be achieved through the critical review of deliverables, participation in the WP Annual Meetings, individual task project meetings, and by providing input to the WP Board. The ERG aims to give emphasis to issues relevant to end user needs and repository implementation, while ensuring that the generation of information is implementable and useful for performance assessment.

After the summer break work on the first SotA was initiated, while additional Task meetings to coordinate remaining experimental details are ongoing.

The logo for the MAGIC project, featuring the word "MAGIC" in white capital letters on a dark blue rectangular background. To the right of the text are three small white circles stacked vertically.

### The MAGIC project has started !

MAGIC's kick-off meeting was held virtually on the 1<sup>st</sup> of July and attracted 55 participants. The meeting aimed at starting officially the different activities of the project. It also allowed MAGIC's partners to get to know each other, to introduce their expected work in the next three years and to discuss together, particularly about the SOTA, the Interactive Data Platform on Cement (IDPC) creation and the Base Cases during the afternoon discussions.

Kick-off meetings for tasks 2, 3 and 4 were organised virtually during the summer and were coordinated by the task leaders. They enabled the tasks participants to have in-depth discussions in order to prepare the planned activities. The first discussions on the SOTA and the Base Cases were initiated.

After the summer break, two meetings were organised virtually: the IDPC development meeting and the Base Cases meeting. The IDPC development meeting aimed at introducing the created Teams group associated with a SharePoint as the possible exchange platform to build a tight and trustworthy relationship between MAGIC's partners. The Base Cases meeting was dedicated to the definition of large-scale modelling cases and enabled modelers and experimenters to have extensive discussions.

## MODATS first workshop and virtual coffee break



The MODATS WP has been launched on 8th June 2021.

The WP proposal has been elaborated remotely, without any face-to-face meeting, since the preliminary discussion. It is why, one of the first action was to find a way to the member team to stay connected along the project period. A virtual coffee break was one of the proposition accepted by the partners. Each month, a short virtual coffee break is organized inside each task to keep people informed and discuss freely about activity or another specific topics. The virtual coffee break give the team some time to get more comfortable with each other.

Technical work in Task 2 is undertaken as an integrated activity, guided and managed through a series of task-wide workshops. The first workshop took place from 18 and 19 August 2021 with one of the objectives to exchange on key research questions dedicated to monitoring data. The workshop was also the place to discuss the reference experiment selected and have a high-level communication on repository monitoring programmes, e.g. the various strategies expected to be adopted and the types of parameters currently envisaged.

The workshop gave the opportunity to all participants to confirm the workplan. In the period also, a survey has been elaborated to collect information about information on monitoring aspects of underground research laboratory (URL) experiments to provide lessons on repository monitoring design and the implications for safety case development. The lessons will focus on the current status of the following topics: Monitoring Parameters, Monitoring Technologies, Design of the Monitoring Sensor System, Lifecycle Quality Assurance and Quality Control and Data Management and Interpretation.

An activity plan has been detailed for each technological development in task 3. A specific document has been elaborated by each of the partners and delivered in September.

Detailed activity plan has been also produced in task 4 dedicated to knowledge management and dissemination.

## SPOTLIGHT

The BACUCE in situ experiments aim to study the interactions between a carbon steel cylinder and cementitious materials in case of an imperfect contact (voids at the interface) and taking into account the impact of microbial activity (BAC-1 & BAC-2) or temperature (BAC-3, BAC-4 & BAC-5). The first BACUCE *in situ* experiment overcoring has been successfully achieved from 5 to 9 July 2021 in the Tournemire URL. An argillite core with a length of more than 1.5 m and a diameter of 24 cm, comprising the experimental device (stainless steel tube in contact with cementitious grout), has been retrieved from the rock massif and then rapidly cut in slices of 5 cm width. These samples obtained after an interaction time of 2.5 years have been then conditioned in aluminized bags to limit any further oxidation process of the metallic tube. Sub-sampling operations are currently performed in both Subatech and IRSN laboratories. Structural characterization of the "metal/grout" and "metal/rock" interfaces will be done soon and first results should be available by the end of the year.

BAC-2 experiment should be overcored by January 2022 (interaction time of 2.5 years). BAC-3, BAC-4 and BAC-5 should be overcored during november-december 2022 period (interaction time of 2 years).



## UPCOMING EVENTS

### November

18<sup>th</sup> Thermodynamic data collection and assessment

24<sup>th</sup> Lunch-and-learn – Dismantling wastes (ROUTES WP and SHARE project)

25<sup>th</sup> PREDIS webinar: State of Knowledge

### January

11<sup>th</sup> - 13<sup>th</sup> – IGD-TP Symposium – The role of optimization in radioactive waste geological disposal programmes

## NOW PUBLISHED!



20 min  
read

### Roadmap Theme 2 Overview on Predisposal

In this theme overview we take a broad look at predisposal best practice, covering the needs of both waste generators and disposal facility implementors.

Learn more [here](#) from Erika Holt of VTT and the PREDIS team who provide signposts to key IAEA documentation and active networks where you can find out more information.



50 min  
read

### Roadmap Theme 5 Overview on Disposal facility design and optimisation

Advanced RWM programmes are using a system integrated approach to design a facility that fulfils safety and security requirements that can be practicably constructed, operated and closed. Experience is shared on the development of specifications for repository geotechnical barriers.

Learn more [here](#) from Michael Jobmann of BGE who shares his many decades of experience working on geological disposal programmes.

## DID YOU KNOW ?



As of August 2021, the website of the 'EURAD School of Radioactive Waste Management' contains an open, interactive forum. The primary aim of this forum is to improve the cohesion and interaction between participants in the EURAD family. There experts, PhD students, civil society members, etc. can discuss diverse topics in the field of radioactive waste management, which are linked to the EURAD Roadmap, but also the 'EURAD School of Radioactive Waste Management' itself. For EURAD PhD students, there are also two dedicated sections where they can discuss amongst each other and share their publications, respectively.

The forum can be reached via the homepage of the EURAD School of Radioactive Waste Management website (<https://euradschool.eu/>) and is open to all. The only requirement is to create an account, and after that you can start and engage in discussions with your fellow EURAD partners. To ensure communication will go smoothly, the main language is English. Should you have any questions regarding this forum, please do not hesitate to contact WP13 via [euradwp13@sckcen.be](mailto:euradwp13@sckcen.be)

## DIGEST - THE COLLEGES OF EURAD: EURADSCIENCE / IGD-TP / SITEX

EURAD brings together a unique mix of skills, experiences and perspectives from researchers, implementors and technical support organisations from across the European radioactive waste management community. Each category is represented by an independent College who, through its representatives in the EURAD Bureau, ensures the interests of its members are represented in EURAD. The Bureau composition was presented at the last General Assembly (see [@here](#)). Below we introduce EURADSCIENCE, IGD-TP and SITEX.Network: the organisations coordinating and facilitating the exchanges within the Colleges of EURAD.

The preparation of the EURAD SRA Update process is a recent example of interaction between the Colleges and the Bureau. In April 2021, the Colleges were invited by the Bureau to provide their views about the goals of the planned EURAD SRA update, as well as the update process to be implemented. EURADSCIENCE, IGD-TP and SITEX.Network have coordinated the response of their respective Colleges to this invitation (Position papers from each College are available on Projectplace). In June 2021, a workshop was organized with several Colleges, Bureau and PMO representatives, as well as the CSOff, to exchange about these position papers. Following this workshop, a draft deliverable D1.8 presenting a joint vision on the goals of the SRA update and the update process to be developed was prepared, in consultation with the Chair of the EURAD External Advisory Board and the PREDIS Coordinator (as PREDIS SRA will be a key input to the EURAD SRA update). The developed vision, goals and general process were approved by the 5<sup>th</sup> EURAD General Assembly. Before the next GA, the Bureau (in coordination with the Colleges and PREDIS) will continue to prepare the implementation of the SRA Update (expected in 2022-2023). The detailed update process will be described in a final version of D1.8, to be approved by the 6<sup>th</sup> GA.



EURADSCIENCE coordinates the EURAD Research Entity College. It is the first international network of research entities established to unite the work of national research organisations on radioactive waste management. Its vision is to maintain a holistic view of relevant scientific disciplines, to provide scientific excellence to advance the progress of national radioactive waste management programmes, and to assure scientific credibility and by this contribute to societal acceptability of waste management concepts. Read their first position paper [@here](#) or view the [EURAD Science April 2021 Lunch & Learn Webinar](#).

IGD-TP coordinates the EURAD Waste Management Organisations College. It is an implementer-led scientific and technology forum for European waste management organisations concerned with deep geological disposal. Its strategic vision is built on R&D needs for industrialisation of radioactive waste disposal in Europe by 2040, via three pillars: (1) safe operation of the first geological disposal facilities in Europe; (2) optimisation and industrialisation of the planning, construction and disposal operations; and (3) development of tailored solutions for disposal of the diverse waste inventories in Europe. Learn more [@here](#) or view the [IGD-TP March 2021 Lunch & Learn Webinar](#).



SITEX.Network coordinates the EURAD Technical Support Organisations College. It is a sustainable network for independent technical expertise on radioactive waste management. Its objective is to enhance and foster cooperation at the international level in order to achieve a high-quality expertise function in the field of safety of radioactive waste management, independent from organizations responsible for the implementation of waste management programs and waste producers, aiming at supporting the Nuclear Regulatory Authorities, as well as the Civil Society. Learn more [@here](#) or view the [SITEX June 2021 Lunch & Learn Webinar](#).

## WP WORDS

Large scale Synchrotron facilities are essential analytical instruments for the characterisation of RN transport and retention mechanisms studied in WP-FUTURE. Travel restrictions and reduced laboratory operation of synchrotron facilities worldwide due to COVID-19, have had a severe impact on the research programme. Despite these difficulties, several research groups have managed to conduct a remote sample processing and eventually to complete significant part of the planned work close to the initial schedule. This was only possible thanks to exceptional flexibility and professional expertise of beam line scientists, as well as the very positive collaborative spirit between beamline user and operators developed in the previous years (FUTURE WP)

Even if DONUT deals with modelling to face the pandemic crisis, every Partner involved in this WP has applied "real life" fundamental principles nicely quoted by Albert Einstein as "Life is like riding a bicycle. To keep your balance, you must keep moving." In DONUT, to keep our balance we keep meeting, developing innovative algorithms and models, publishing papers, mentoring young PhD students or postdoc. Was everything perfect? Probably not, but believe us we do our best!

The pandemic has speed up the development of using video meetings and digital co-working tools, e.g. projectplace, which will be very beneficial in the future, long after Corona has gone (WP11)

"The work of a strategic study depends significantly on the ability of participants to meet and exchange with each other. Therefore, the COVID-19 crisis has had an impact on the dynamics of the whole ROUTES' Work Package (WP), especially during the first six months. Indeed, a great effort was made to rebuild and even strengthen the dynamics: a different organization was established. More frequent and shorter meetings (SIX TIMES GREATER than the number originally planned) were held and few-day workshops were replaced by more frequent few-hours online meetings. The WP managed to experiment more innovative working methods such as country-specific interviews (Task 6) or short thematic meetings (Task 2). This has led to a workload increase, but it has not prevented the WP from strengthening its interaction with other projects through the organization of joint webinars." (ROUTES WP)

## PHD CORNER

### **Abdellah Amri 2021-2024 – Framework: EURAD DONUT (WP4)**

**Supervised by:** Dr. Zakaria Saâdi (IRSN) and Pr. Rachid Ababou (IMFT)

**Title:** A revised hydrogen transfer model for the study of hydraulics-gas transient in a deep geological



This thesis is part of the research and expertise activities that IRSN is carrying out for the aim of understanding and modelling gas migration mechanisms in the context of the project of the Industrial Geological Storage Center for radioactive waste (Cigeo). This work contributes to the determination and evaluation of the gas migration mechanisms in the vicinity of a radioactive waste disposal site, through numerical modelling of two-phase (water-gas) flows in porous media, sensitivity analysis of input parameters, and comparison with on-site experiments. In particular, this work takes into account gas entry pressure and hysteresis of retention and relative permeabilities curves overlooked in previous studies, through theoretical aspects, computer codes implementation, and a sensitivity analysis. For each physical phenomenon, an analysis of the experimental data was carried out in order to develop or test some physical models. The chosen models are implemented in the TOUGH2 code platform with some verification and validation tests, and gas or soltrol 220 injection experiments were modelled in order to test the impact of these phenomena. The modelling of gas migration at the waste cell scale underlined the importance of these phenomena for the evaluation of the migration of gases in a radioactive waste disposal site.

## PHD CORNER

### Charlotte Dewitte: 3<sup>rd</sup> year of PhD at IRSN- France

**Title:** Precipitation of silico-magnesian phases (M-S-H) in cementitious materials: evaluation and understanding of the chemo-mechanical impact



Graduated in 2019 from Mines d'Albi with a specialization in civil engineering at Mines d'Alès (France), she started her PhD in October 2019 at the Institut de Radioprotection et de Sécurité Nucléaire (IRSN) and the Materials and sustainability laboratory for constructions (LMDC) in France. Her thesis contributes to the MAGIC project by quantifying the multi-scale chemical-mechanical evolution of cementitious materials under the expected chemical degradation in repository environments. Indeed, magnesium enrichment of cementitious materials can be observed in the context of a deep geological disposal facility, for radioactive wastes at the interface of cement-based materials and clayey rock. This enrichment was characterized by the precipitation of magnesium-containing phases, including magnesium silicates hydrates (M-S-H). The formation of M-S-H results from the decalcification of C-S-H and raises the question of the mechanical integrity of concrete where M-S-H precipitates. With the purpose of determining the mechanical properties of M-S-H and predicting the long-term behaviour of cementitious materials, a multi-scale study is carried out in which M-S-H are characterised for increasingly complex systems: M-S-H pastes, C-S-H pastes and cement pastes immersed in a magnesian solution.

During the first two years of the PhD, M-S-H cohesive pastes were produced and chemo-mechanical and microstructural characterizations were performed. Different types of C-S-H pastes and cement pastes were produced and put in  $MgCl_2$  solutions in order to form M-S-H. The presence of portlandite in several pastes was observed causing the precipitation of a brucite layer, preventing the precipitation of M-S-H. Thus, a chemo-mechanical and microstructural analysis is underway on low pH cementitious pastes lacking portlandite. One is a simplified low-pH cement paste composed by Portland cement and colloidal silica, the other is a low-pH formulation being considered for the radioactive waste geological disposal project. Simultaneously, the influence of chemical evolution on mechanical behaviour is modelled in order to predict the influence of M-S-H precipitation on cementitious materials.

She submitted an application to the EURAD mobility programme in order to receive funding for a two-week training with Finnish partners to learn a method to characterize the porosity of her samples (autoradiography). Once her thesis is finished, she would like to further her research on cementitious materials.

## PHD CORNER

### Rosa Ester Guidone

**Title:** Sorption of low molecular weight organics on cement phases and CEM I and their effect on radionuclide uptake



I am a PhD student working since November 2019 within the WP3 EURAD project CORI, Cement-Organics-Radionuclides-Interactions. I obtained my Master's degree in Science and Technology of Industrial Chemistry at the University "Federico II" (Naples, Italy) in 2018. My PhD study takes place as a shared appointment between the Laboratory Concrete & Asphalt at Empa, the Swiss Federal Laboratories for Material Science and Technology, and the Institute for Nuclear Waste Disposal (INE) at the Karlsruhe Institute of Technology (KIT) in Germany.

My PhD work is dedicated to study the interaction between the main cement phases (C-S-H, ettringite and AFm), short-chained organic ligands (formic, citric and gluconic acids) and radionuclides (Eu(III), Cm(III) and Pu(III/IV)). The selected organic ligands are representative for decontamination agents present in low and intermediate level wastes (L/ILW), cement additives or degradation products of more complex organic materials. Plutonium is one of the most relevant radionuclides in nuclear waste, whereas actinides in the oxidation state +III and +IV are expected in the reducing conditions foreseen in underground repositories.

Although actinides strongly sorb onto cementitious materials, organic ligands present in the waste can importantly affect their retention properties due to both the formation of stable complexes in the aqueous phases and the alteration of the surface properties of cement. In order to separately assess the different contributions of organics and radionuclides, my work is divided in two complementary blocks: the first part conducted at Empa focuses on the effect and sorption of organics on the cement hydrates, whereas the second part at KIT-INE is dedicated to investigate the ternary systems cement-organics-radionuclides. The latter part is complemented with solubility experiments with pure radionuclide phases, *e.g.* PuO<sub>2</sub>(s), in order to gain insight on the aqueous speciation of these radionuclides in the presence of the selected organic ligands. The speciation of radionuclides in the cementitious materials is investigated with advanced spectroscopic techniques, *e.g.* Time-Resolved Laser Fluorescence Spectroscopy (TRLFS) or X-ray Absorption Fine Structure (XAFS). My first results on the binary system cement-organics suggest that the uptake of organics can affect the structure of cement hydrates, and that this uptake is facilitated by the presence of calcium in the solid. Distribution ratios and sorption isotherms determined in this work support that the affinity of the organics for cement hydrates is related to the type and number of functional groups.

This work will provide definitive insights on the mechanisms and processes driving the uptake of radionuclides by cement in the absence and presence of organic ligands, and further allow a quantitative description of such phenomena. I have presented my PhD work in several international conferences, and I am happy to have been recently awarded the prize to the "Best Hot Topic Paper" at the European Nuclear Young Generation Forum (ENYGF) celebrated in September 2021 in Tarragona (Spain).

## WE ARE OUT THERE



Fisicoquímica de Actínidos y Productos de Fisión

@FFision

Last contribution of @FFision researchers to Transret workshop, organised by @KITKarlsruhe . Participating to CORI project funded by @EJP\_EURAD .

[Traduire le Tweet](#)



4:55 PM · 12 oct. 2021 · Twitter for Android

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