



“By 2025, the first geological disposal facilities for spent fuel, high-level waste and other long-lived radioactive waste will be operating safely in Europe.”

Editorial

Dear Readers,

I am honoured to take over as IGD-TP Chair from January 2017, ably supported by the new secretariat team (Robert Winsley, Johanna Hansen and Tamara Baldwin), particularly at a time in the collaboration of research at the European level when a great deal is happening. We thank our out-going chair, Monica Hammarström, and secretariat team of Jacques Delay and Marie Garcia, for their excellent work over the last few years and their support during this transition.

I was incredibly pleased to see the progress made in the technical work presented at the 7th IGD-TP Exchange Forum, held on 25-26 October 2016 in Córdoba, Spain. It was a fantastic meeting and our hosts, ENRESA, should be congratulated. However, we were shocked and saddened to hear of the untimely death of our ENRESA host and EG member, Pablo Zuloaga, at Christmastime. Pablo was very happy and proud to host the Exchange Forum in his home town and our experience in Córdoba will long live with us. He will be sorely missed.

Three of our key EC-funded research projects (BELBaR, DOPAS and LUCOEX) were closed out at the 7th Exchange Forum, but four new projects were successful in the EURATOM call 2016-2017. In this sixth issue of our newsletter, you will find information on the newly launched projects (BEACON, CHANCE, DISCO and THERAMIN), as well as an update on some of our ongoing projects (CAST and JOPRAD).

The EC is expected to launch a call for establishment of a Joint Programme in the field of Radioactive Waste Management and Disposal (RWMD) as part of the Euratom Work Programme 2018 in May 2018. In order to be ready to submit a proposal by September 2018, proposal development needs to be undertaken now. Outside of the auspices of the IGD-TP, a core group of waste management organisations, research entities and technical services organisations has started work to facilitate the development of a proposal for a European Joint Programme (EJP). We thank Andra for their commitment to supporting the future EJP by their provision of time and resource in co-ordinating the proposal development, and individually thank Frédéric Plas (Andra) and Monica Hammarström (SKB) for representing the IGD-TP view in that development. Further information on the EJP development is provided in this newsletter and all interested organisations should get involved.



We are not planning an IGD-TP Exchange Forum this year as we recognise there has already been significant collaboration at the European level this calendar year, culminating in the workshop on the JOPRAD Programme Document, which supported an EU-wide consultation on joint programming. This took place on 4th April 2017 in London, UK, and successfully gathered about 100 participants from 22 countries. However, we do plan an engaging Exchange Forum next year where we will continue to rely on your active participation to fulfil our ambition of reaching the highest level of excellence and efficiency in geological disposal research.

Jon Martin, IGD-TP Chair

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Past Events

7th IGD-TP Exchange Forum (EF7)

The IGD-TP 7th Exchange Forum was themed around increasing the maturity of technology. It was successfully held on 25-26th October 2016 in Cordoba, Spain. It took the opportunity to update members on the platform activities during 2016, inform the community on the outcomes of the recently completed BELBaR, LUCOEX and DOPAS projects and collectively explore the potential of future Joint Activities (through four subject specific working groups).



Exchange Forum 7, October 2016, Cordoba, Spain

EF7 summarised some of the key future research needs as currently envisaged by Waste Management Organisations (WMOs), Technical Support Organisations (TSOs) and Research Agencies, and opened the discussion up to the audience via a panel question and answer session. This session included a short summary following the Mid-Term Workshop detailing what Joint Programming is and is not, and also summarised the agreed ground rules for defining technical activities would be suitable for future Joint Programming.

This Exchange Forum was useful in helping to prepare for anticipated future projects calls, and also initiate or increase interaction between research organizations, waste producers and WMOs. Output from two of the Working Groups (WGs) has been carried forward into projects proposed by the EJP Core Group in their recent expression of interest work: WG3 considering the influence of temperature on clay-based material behaviour; and WG4 spent fuel characterisation and evolution.

WG1 – Industrialisation and optimisation

WG3 - High temperature clay interactions

WG2 - Canister design

WG4 - Spent fuel characterization



News & Activities

European Joint Programme (EJP)

A core group of organisations deeply involved in the joint programming process was established in January 2017 (Andra, France ; Bel V, Belgium ; CNRS, France ; CV REZ, Czech Republic ; IRSN, France ; JRC, EC ; MUTADIS, France ; SKB, Sweden). Coordinated by Andra, this group will act as facilitator in the proposal development phase for the future Euratom call for joint programming. Organisations in Europe carrying out research in the field of RWMD were invited to express their interest in the individual technical projects and networking activities by 10th May 2017. It is anticipated that individual activity groups will be established this summer, based on the inputs that the EJP Core Group received. This means that first meetings of each potential project would probably be held in early September 2017.

In related news, the launch of the Euratom Work Programme 2018 has been postponed to May 2018 (for an expected call submission date in September 2018).

For further information contact the coordinators at RWMD-EJP1@andra.fr

National Update - Finland

In November 2015 the Finnish Government granted a licence to Posiva for the construction of a final disposal facility for spent fuel. After extensive and multidisciplinary research and development work Posiva can now proceed to construction of the final disposal facility in Olkiluoto according to the concept it has developed. The final disposal of the spent fuel generated in the Olkiluoto and Loviisa nuclear power plants into the Finnish bedrock is planned to start in the early 2020's.

The Government's favourable decision for Posiva's construction licence application is recognition of the extensive R&D work carried out by Posiva for more than 40 years to develop a safe final disposal solution for spent nuclear fuel. After gaining research results and experience from the underground rock characterisation facility ONKALO™, Posiva is now about to move on to the construction of the final disposal facility on the island of Olkiluoto in Eurajoki, Finland.



ONKALO™ underground disposal facility for spent nuclear fuel

Posiva Oy and YIT Construction Ltd signed a contract in November 2016 for excavation of the first tunnels for Posiva's final disposal facility. The value of the contract is about EUR 20 million, and the estimated employment resulting from the contract, including the subcontractors, is about 100 – 125 person years.

YIT started the excavations in December 2016. The total length of this project phase is estimated to be about two and a half years. The contract covers, for example, the excavation of the first central tunnels as well as the vehicle access tunnels to them. Preparatory excavations are also carried out as well as rock sealing works in preparation for the raise boring of a canister shaft where the canister lift will later be installed. Excavation works for the canister receiving station at the depth of ca. 430 metres are also part of the contract.

Simultaneously, Posiva is preparing the Full-scale in-situ system test (FISST), which demonstrates the feasibility of installation of engineered barrier system (EBS) components, achievement of the initial state and provides data from initial evolution of the system.

For further information see <http://www.posiva.fi/en>

Towards a Joint Programming on Radioactive Waste Disposal

JOPRAD

The aim of the JOPRAD project is to assess the feasibility of and prepare for the establishment of a European R&D Joint Programme that would bring together all R&D actors in the field of geological disposal for high-activity long-lived radioactive waste and spent fuel.



JOPRAD Mid-Term Workshop

JOPRAD held its **Mid-Term Workshop** on 7-8th September 2016 in Prague, Czech Republic. As a key milestone of JOPRAD, it gathered about 80 participants from 19 countries (Europe and beyond). The rationale for Joint Programming (including benefits and challenges), the strategy and the technical common priorities were presented and discussed at the Workshop. Contractual instruments as well as governance rules and the possible financing schemes were also outlined.

The workshop enabled participants to reach a common vision on the way forward for the setting up of a Joint Programme between Member States at the European level. In addition, it was also an opportunity for Civil Society stakeholders to bring in their interests and ways to be involved in the different activities, as well as participation in Governance.

JOPRAD Programme Document

The draft **Programme Document**, the main outcome of the JOPRAD Project, was presented at a workshop on 4th April 2017 in London, UK. The workshop gathered about 100 participants from 22 countries (EU Member States and associated countries) with representatives mainly from:

- Waste Management Organisations;
- Technical Support Organisations and Research Entities;
- Civil Society stakeholders;
- Ministries, national/regional authorities (programme owners);
- European Commission.

The Programme Document will form the scientific and technical basis of future European Joint Programmes (EJP) and addresses:

- Background, benefits and boundary conditions for a JP;
- Key Research, Development and Demonstration (RD&D) domains as well as Knowledge Management (KM) activities that could be included in a future EJP, consistent with the national programmes requested by the Council Directive 2011/70/Euratom;
- The methodology that was used within JOPRAD to identify these domains/topics;
- A proposal for governance and implementation mechanisms of such an EJP.

An open consultation on the draft Programme Document was held between 13th March and 30th April 2017, with feedback particularly sought on the Strategic Research Agenda. The comments received are now being analysed and the finalised Programme Document will be published shortly.

Further information is available at www.joprad.eu.

New H2020 Technical Projects

JA10a - Bentonite Mechanical Evolution

BEACON



The overall objective of the Beacon project is to develop and test the tools necessary for the assessment of the hydro-mechanical evolution of an installed bentonite barrier and its resulting performance. This will be achieved by co-operation between design and engineering, science and performance assessment. The evolution from an installed engineered system to a fully functioning barrier will be assessed. One of the challenges is to take into account initial heterogeneities introduced in the system by conception with a combination of block and pellets or due to the size of the bentonite component (several 100m³).

The first Beacon international scientific workshop on Mechanical Properties of Bentonite Barriers was held at the Lithuanian Energy Institute in Kaunas, Lithuania, on 19th and 20th June 2017. The main aim of the Beacon Initial Workshop is to establish a network of specialists in support of the project, and further to initiate a process leading to successful dissemination of the results. One of the primary objectives is presentation of relevant information that is available from national and international projects at the beginning of the Beacon project that are relevant to explore the role of heterogeneities in bentonite components on long term performance assessment.

Further information contact the BEACON coordinator Patrik Sellin (patrik.sellin@skb.se) or see <http://www.beacon-h2020.eu/>

JA11d - Characterisation of Conditioned Nuclear Waste for its Safe Disposal in Europe

CHANCE



The CHANCE project “Characterization of conditioned nuclear waste for its safe disposal in Europe” aims to address the specific issue of the characterization of conditioned radioactive waste. The project started in June 2017 for a 4 year period.

The first objective of CHANCE is to establish, at the European level, a comprehensive understanding of current conditioned radioactive waste characterization and quality control schemes across the variety of different national radioactive waste management programmes, based on inputs from end-users such as Waste Management Organisations, storage operators and radioactive waste producers. This first objective will be addressed through activities of CHANCE work package 2 “Methodology for conditioned radioactive waste characterization: Problematic wastes and R&D proposal” (WP2).

The second objective of CHANCE is to further develop, test and validate techniques already identified that will undoubtedly improve the characterization of conditioned radioactive waste. Specifically, the work on conditioned radioactive waste characterization technology will focus on:

- Calorimetry as an innovative non-destructive technique to reduce uncertainties on the inventory of radionuclides (work package 3);
- Muon Tomography to address the specific issue of non-destructive control of the content of large volume nuclear waste (work package 4);
- Cavity Ring-Down Spectroscopy (CRDS) as an innovative technique to characterize outgassing of radioactive waste (work package 5).

The kick-off meeting of the CHANCE project was held on June 12th and 13th in Brussels. The first task of CHANCE will evaluate the requirements and methodologies for the characterization of conditioned radioactive waste used in different national contexts. A questionnaire will be prepared and used to collate information on this topic. This questionnaire will be sent to CHANCE End-User Group.

Anyone who is interested in participating in the CHANCE End-User Group is invited to contact the project coordinator, Stéphane Plumeri.

For further information contact the CHANCE coordinator Stéphane Plumeri (Stephane.Plumeri@andra.fr)

New H2020 Technical Projects

JA1a - Modern Spent Fuel Dissolution and Chemistry in Container

DISCO



While the scientific understanding of the dissolution of standard spent uranium oxide fuel has reached a certain mature state, new types of fuels with additives (“doped fuels”) have been developed. These fuels are already in use in some reactors, and their use is foreseen to be expanded. Dissolution data is now required to confirm that the dissolution behaviour of such fuels in a geological repository environment is similar to that of standard fuel. Similarly, there is a dearth of dissolution data from MOX fuels, which are also currently in use in several reactors. This project is therefore targeting oxide fuels containing additives, including Cr, Gd and Pu, in order to ensure that relevant characteristics are understood to a level commensurate with standard fuels. This project aims to expand the database on spent fuel dissolution with results from dissolution studies performed in truly reducing conditions, with hydrogen present. The effects of dopants will be investigated through experiments using both spent nuclear fuel and synthetic materials specifically designed for the project. In addition, chemical modelling will be employed to improve the understanding and description of the dissolution process relevant to the expected chemical conditions inside a failed waste container in a deep geological repository environment.

For further information contact the DISCO coordinator *Lena Zetterström Evins* (Lena.z.evins@skb.se)

JA1b - Thermal Treatment for Radioactive Waste Minimisation and Hazard Reduction

THERAMIN

The THERAMIN project will provide an EU-wide strategic review and assessment of the value of thermal technologies applicable to a broad range of waste streams (ion exchange media, soft operational wastes, sludge, organics and liquids). THERAMIN will compile an EU-wide database of thermally treatable wastes, will document the strategic benefits of thermal treatment, and will identify the opportunities, synergies, challenges, timescales and cost implications to improve radioactive waste management. THERAMIN will evaluate the applicability and achievable volume reduction of the technologies through ‘first-of-a-kind’ active and non-active full-scale demonstration tests, and will assess the disposability of residues.



The project benefits from the large investments made by partners in thermal treatment R&D facilities, which will be utilised to maximise the benefit across Member states. THERAMIN will benefit from close engagement with an End User Group (waste producers and waste management organizations). The partners will encourage the mobility and training of staff for the development of the next generation of engineers and scientists, and the proposal includes a technical training workshop, a scientific conference, and use of other dissemination tools. THERAMIN will establish a pan-European network of expertise on thermal treatment, will provide for cross-European technology transfer, and will identify prospects for sharing of facilities between countries facing similar problems.

The project started in June 2017 and the overall duration will be 3 years. Work will start by compiling a database of thermally treatable radioactive waste streams and treatment technologies, assessing the applicability of different treatment technologies for these waste streams, and selecting test materials for each treatment technology to be used for experimental work, followed by demonstrations of thermal treatment technologies.

For further information contact the THERAMIN coordinator *Mr Matti Nieminen* (matti.nieminen@vtt.fi)

Ongoing Technical Projects

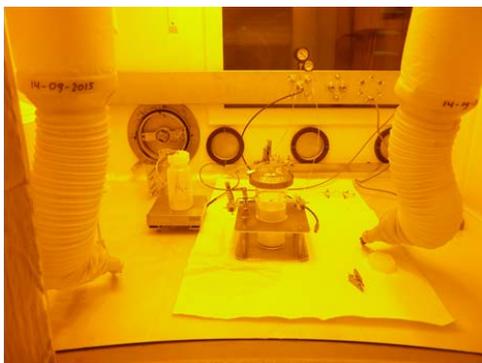
JA3 - Waste forms and their behaviour C14

CAST



The CAST Project (Carbon-14 Source Term) aims to develop understanding of the potential release mechanisms of carbon-14 from radioactive waste materials under conditions relevant to waste packaging and disposal to underground geological disposal facilities. The project began in October 2013 and runs for 54 months. Reports published on the CAST website since June 2016 include the third year annual reports from Work Packages (WP) 3, 4 and 5 on Zircaloy, ion-exchange resins and graphite respectively.

Results from WP2 on steels have shown very low chronic corrosion rates of less than 1 nm y^{-1} for stainless steel at high pH and in deionised water. Early results from the leaching of an irradiated stainless steel has found a quick release of about 0.0005% of the carbon-14 but a slowing rate of release after a few weeks. Most of the carbon-14 is released to solution with only between 1 and 10% released as gas (predominantly as ^{14}C -hydrocarbon). The observation of a quick initial release is similar to that seen for carbon-12 release from unirradiated iron powders.



Leaching vessel for irradiated stainless steel in hot cell (courtesy of NRG)

Long-term leaching of irradiated BWR Zircaloy in deoxygenated sodium hydroxide solution also showed very low rate of release of carbon-14 (about 0.004% in 6½ years) with evidence that the release rate slows after the first few years.

Methodologies for the determination of total carbon-14 on spent ion exchange resins and its distribution between organic and inorganic forms have been developed.

Studies of implanted carbon-13 have been used to simulate the behaviour of carbon-14 in irradiated graphite during reactor operations. These studies have shown that reordering of the graphite occurs during thermal annealing. Implanted carbon-13 is stabilised into the graphite structure with the proportion depending on the irradiation and temperature regime. Separate studies on thermal and ultrasonic treatments of irradiated graphites lead to the inference that much of the carbon-14 in irradiated graphite is tightly bound.

The first CAST training course and first workshop have been held. The training course on 'C14 behaviour under repository conditions' included lectures and practical training and was held on 5/6th July 2016 in Germany. The workshop was held on 5/6th October 2016 in the Netherlands with a focus on R&D carried out in CAST and example treatments of carbon-14 in national safety assessments.

The final conference on CAST will be held in Lyon on 16th to 18th January 2018. The First Announcement and Call for papers has been issued and is available from the front page of the CAST website. Submission of abstracts is invited for posters and presentations with a deadline of 1st September 2017. Papers from the symposium will be considered for inclusion in a Special Edition of the Radiocarbon (RDC) journal.

Reports from CAST can be downloaded from the publications page of the CAST website at::

<http://www.projectcast.eu/>

The project has received funding from the European Union's European Atomic Energy Community's (Euratom) Seventh Framework Programme FP7/2007-2013 under grant agreement no. 604779, the CAST project.

SAVE THE DATE!

Goldschmidt Conference

Date: 13-18 August 2017

Place: Paris, France

4th International Conference on Radioecology and Environmental Radioactivity (ICRER)

Date: 3-8 September 2017

Place: Berlin, Germany

7th Clay Conference

Date: 24-27 September 2017

Place: Davos, Switzerland

Final JOPRAD Workshop

Date: 16 November 2017

Place: Prague, Czech Republic

Final CAST General Assembly Meeting

Date: January 2018

Place: Lyon, France

For more information see www.igntp.eu

The 7th Clay Conference

After Reims 2002, Tours 2005, Lille 2007, Nantes 2010 and Montpellier 2012 (all organised by ANDRA), and Brussels 2015 (organised by ONDRAF/NIRAS), we are pleased to inform you that the 7th International Conference on Clays in Natural and Engineered Barriers for Radioactive Waste Confinement will take place from 24 – 27 September 2017 at the Congress Centre in Davos (Switzerland).

The purpose of the seventh International Conference is to gather together specialists in the different disciplines related to clays and clay minerals and scientists from organisations engaged in radioactive waste disposal, in order to evaluate the progress of the research being conducted in this field.

The conference is organised by Nagra (Switzerland), in cooperation with ANDRA (France), COVRA (The Netherlands), KORAD (South Korea), NUMO (Japan), NWMO (Canada), ONDRAF/NIRAS (Belgium), POSIVA (Finland), PURAM (Hungary), RWM (United Kingdom), SKB (Sweden), SURAO (Czech Republic) and Swisstopo (Switzerland).

For further information see <http://www.clayconferencedavos2017.com/congress.html>

EC Project Newsletters

Newsletters for ongoing EC radioactive waste management projects can be found at:

- CAST - <https://www.projectcast.eu/publications/newsletters> (May 2017)
- CEBAMA - <https://www.cebama.eu/Home/Newsletters> (November 2016)
- JOPRAD - http://www.joprad.eu/fileadmin/Documents/Newsletters/JOPRAD_Newsletter_2.pdf (December 2016)
- MIND - <http://www.mind15.eu/okategoriserade/newsletter-3-march-2017/> (March 2017)