IN THIS ISSUE:

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The PREDIS (Predisposal Management of Radioactive Waste)

project finished its first year in August 2021. Giant steps were taken in strategic development topics and knowledge management tasks and important foundations of technical work were laid with particular focus on end user needs and priorities. Project activities and achievements are actively disseminated through the PREDIS website.

Significant milestones were reached in strategic implementation actions. The gap analysis evaluating industry and stakeholder needs for research, development and demonstration in predisposal waste management technologies, which included further review, refinement and prioritisation of technical project plans, was finalised. International approaches to establishing waste acceptance systems were studied and collated. A strong effort was also put on drafting the Baseline Strategic Research Agenda on predisposal. These and other public reports are freely available at the PREDIS website publications page.

In Knowledge Management, the first mobility call intended for younger generations in particular (but not only 😊) was launched and the mobility programme will continue throughout the project. As COVID-19 travel restrictions ease, PREDIS encourages active collaboration between PREDIS partners as well as visits to industry or other relevant organisations. End users are welcome to volunteer to host short stays for our talented young generation. Training activities based on predisposal issues in the EURAD Roadmap will start next year. Cooperation with the EURAD project carries on and a Joint Statement on Knowledge Management was published in October.

We continued the public webinars series with five new events this autumn: Waste Acceptance Criteria from the standpoints of 1) Information and Resources and 2) Needs, Challenges and Opportunities; the PREDIS Gap Analysis and defining the baseline Strategic Research Agenda; Waste Characterization together with CHANCE project; and Geopolymers. As usual, the webinars had considerable outreach and lively interaction in the breakout room sessions. If you missed any of these or past webinars, presentations, summaries and, in many cases, recordings are available on the PREDIS website.

In this newsletter you can explore more about Knowledge Management activities in PREDIS, get updates from technical work packages, and get to know more of our PREDIS partners. We wish you all welcome to follow our actions and accomplishment via our website, online webinars and project workshops exclusive for our End User Group (EUG) members. Next EUG event online will occur on Friday 3.12.2021, registration link included to the Newsletter.

-Maria Oksa (VTT), Project Coordinator

Dissemination & Outreach

REMINDER

Online PREDIS Consortium Meeting

Friday 3.12.2021 from 09:00-17:00 CET

(afternoon session open to End User Group (Industry) members)

Register at:
https://www.lyyti.fi/reg/PREDIS_consortium_meeting_031221

We are back out there, in-person!

Rebecca Robbins (Predisposal Team Leader, Waste Technology Section, IAEA) and Erika Holt (PREDIS Co-coordinator, VTT)

The PREDIS project participated, in-person, to the IAEA International Conference on Radioactive Waste Management: Solutions for a Sustainable Future on 1–5 November 2021 in Vienna, Austria with an e-poster, a formal presentation plus a panel discussion among other Euratom projects during the "Collaborative Research and Innovation in RWM in the Euratom Community" side event and, of course, numerous informal discussions. The presentation itself highlighted the worldwide impact of Euratom projects, including the development of knowledge management issues and strategic research agendas, providing support for early-stage programs and serving as discussion forums among stakeholders having common interests. Video recordings and presentations from the event will be made available at the PREDIS presentations web page. The conference stressed the overall importance of an integrated waste management approach, promoting the key role of predisposal activities inclusive of strong links between efficient decommissioning and disposal. Erika Holt (VTT, WP1 co-coordinator) and Ernst Neiderleithinger (BAM, WP7 leader) were in attendance, as well as were other PREDIS partner representatives.

Panel discussion moderated by EC officer Seif Ben Hadj Hassine, discussing complimentary nature of projects SHARE (decommissioning), MICADO (characterization), PREDIS and EURAD. 4.11.2021.

End User and Stakeholder Community

We are happy to welcome Low Level Waste Repository (LLWR) Ltd. from the UK as the newest member of our End User Group (EUG). The interest of LLWR Ltd. in the PREDIS project covers all of the technical WPs (4-7) as well as knowledge management (WP3).

The membership of the ITER Organization (France) to the EUG is anticipated to be approved at the next PREDIS General Assembly meeting (December 2021).

PREDIS currently has 25 EUG members from waste owner, waste generator (e.g., NPP operators) and waste management organizations, and we hope to have more. A full listing of EUG members can be found on the PREDIS website End User Group page. The benefits of EUG membership were described in Newsletter 2 (April 2021) and are highlighted by accessibility to meetings and discussions about the direction of the project to ensure high impact and benefits to our end users.

Other parties such as research institutes, technical support organisations, universities, regulators and supply chain members are most welcome to register to our Stakeholder group so as to receive updates of our project progress and receive public event invites.

COME AND JOIN US! REGISTER TODAY!

Knowledge Management in PREDIS

This newsletter features the activities of Work Package 3 on knowledge management. The identification, assessment, structuring and dissemination of past and present knowledge of pre-disposal R&D activities accumulated within the European Commission R&D programmes, as well as in international and national radioactive waste management organisations, is of vital importance for early-stage programmes, advanced programs and future generations. It is the objective of PREDIS WP3 to provide access to this knowledge in a systematic and structured way to PREDIS beneficiaries and ultimately to the entire European pre-disposal community.

WP3 is led by JRC but there is active co-leadership with Amphos21 and UJV complemented by the involvement and contributions of IMT, SCK CEN, BAM, UNIPI and GSL. Amphos21 leads tasks 3.1 (Knowledge Management Program) and 3.3 (Training) and UJV leads tasks 3.2 (State of Knowledge) and 3.4 (Mobility).

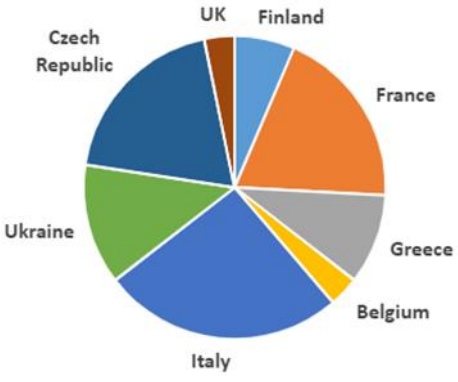
One of the main achievements during the first year of the project is the Mobility Programme. The PREDIS mobility programme aims at facilitating cooperation between partners and Member States with regard to the identification and acquisition of tacit knowledge (from different subject areas) needed to develop a professional career in the predisposal management of radioactive waste.

The PREDIS mobility and training programme is described on the PREDIS website including links to the mobility manual and mobility portal (where registrations and applications can be submitted).

The PREDIS mobility programme covers the following types of mobility actions: visits to partners or industry, internship/exchange programmes, training course participation and attending technical events (i.e., conferences, workshops). We are happy to have received the first application, which has been accepted. The mobility programme will continue with several application periods per year until 2024.

PREDIS Mobility Scheme

A PREDIS Student Community has been established within the project to improve networking and transfer of knowledge. At present, the group includes 31 students from 8 countries. About half of these students are performing their PhD. Their work spans all of the technical work-packages.



Distribution of PREDIS students by country.

The 1st Students' Workshop took place on October 5 as a virtual event and it was the beginning of a series of workshops where students will have a forum to share their concerns, present their work, be informed on future Knowledge Management activities, etc. The next event will take place during the forthcoming Annual Meeting.

If you would like to become a member of the PREDIS Student Community and get involved in all the activities that will be available for the PREDIS younger generation, please contact alba.valls@amphos21.com or vaclava.havlova@ujv.cz.

WP3 leads: Paul Carbol, Joint Research Centre (JRC), DE, Alba Valls, Amphos21, ES and Vaclava Havlova, UJV Rez, CZ

From this newsletter going forward, two students will present themselves so that readers will get to know them and the work they will perform in the frame of PREDIS.

Yasmine HELAL is a chemical engineer specialized in material sciences, currently pursuing a master's in project and strategic management along working as project assistant on PREDIS project with Orano. She is working in WP7 on Innovations in cemented waste handling and pre-disposal storage mainly on task 6 (Demonstration and Implementation).

This journey has been highly fulfilling and enriching as it represents her first experience working on a European project involving numerous stakeholders, with a high environmental impact and a valuable innovation component. She believes that managing radioactive waste is extremely crucial especially with the increase of reliance on nuclear energy in Europe.

She is expecting that through this multi-partner initiative, there will be more collaborative opportunities in the future which results in a better access to knowledge. She is looking forward to seeing how the next chapters unfold.

Dimitrios MAVRIKIS is a physicist and holds a master's degree in Astrophysics, Astronomy and Mechanics from the National and Kapodistrian University of Athens. He is a PhD student in Radiological Characterization of Radioactive Waste. Since 2017 he has been a member of the Radioactive Waste and Material Laboratory at NCSR "Demokritos". The Laboratory operates the Centralized Facility of Radioactive Waste & Sources in Greece.

In the framework of his research activities, Dimitrios deals with the development of non-destructive gamma spectroscopy techniques using the MCNPX code for simulations, including the radiological characterization of metallic waste.

Regarding the PREDIS program, he participates in subtasks 4.5.1 and 4.5.2. His work focuses on Monte Carlo simulations in order to determine the optimum parameters of the measuring setup for the classification of metallic waste before decontamination. The aim of this work is the significant reduction of the uncertainty in metallic waste classification, as well as to achieve an acceptable measuring time for large amount of metallic waste.

Concerning participation in PREDIS KM activities, he expects to exchange knowledge and strengthen international collaborations and networking.

Work Package Updates

WP2: Strategic Implementation

WP2 is led by NNL with strong participation from WP2 partners. Furthermore, given the strategic nature of the Work Package, the interactions with other PREDIS partners, End Users and Stakeholders are significant.

The first year of the PREDIS project was an important year for the WP2 activities and the team has made great progress and published several key reports. Task 2.1 led by SCK CEN has created a strong network of end users and stakeholders, from Europe and beyond. It is through this extensive network that PREDIS has successfully engaged the relevant 'communities' in our activities. However, the project encourages further applications to join the End User and Stakeholder Groups.

The Task 2.2 team led by NNL has published a baseline Strategic Research Agenda for Pre-disposal waste management, based on an analysis and consolidation of published SRAs from key international groups. This baseline SRA will form the starting point for stakeholder dialogue as the team develop the SRA further in subsequent periods. Alongside this activity, the Task 2.6 team led by VTT implemented an open and transparent Gap Analysis exercise with extensive stakeholder engagement, which confirmed the alignment of the scope of the PREDIS programme with stakeholder needs.

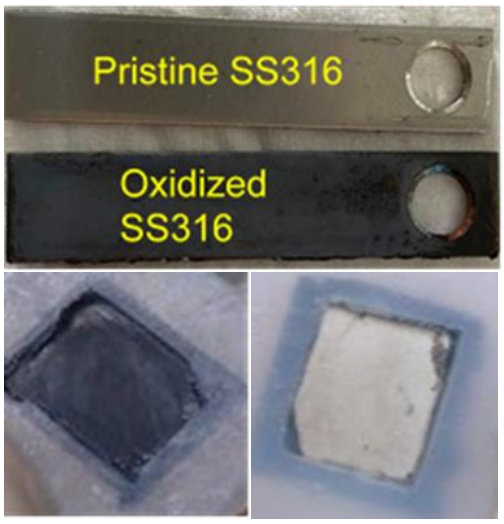
The task 2.3 team (led by CVRez) commenced work in year 1, with a review of international approaches to establishing waste acceptance systems. This report published in September, will inform the next stages of work on WAC. In task 2.5 (Life Cycle Assessment) led by CEA, the University of Manchester have prepared and published a protocol for the application of Life Cycle tools that will be used subsequently to evaluate PREDIS technology developments through Case Studies. We are also delighted to welcome two PhD researchers Rachael and Joel to WP2, who will work with WPs 4-7 to develop the LCA models and prepare the case studies.

There has been extensive engagement and communication activity from WP2 during this first year and all published reports and details of the various webinar presentations are available from the PREDIS Website.

WP2 lead: Anthony BANFORD, Matthew RANDALL and Aaron Ellis , National Nuclear Laboratory (NNL), UK

WP4: Innovations in metallic material treatment and conditioning

The last 6 months have been rich not only in experimental and theoretical developments, but also in management and dissemination activities. Several technical meetings have taken place within the WP task groups and a number of abstracts were submitted for various conferences and workshops. Additionally, three milestone documents have been submitted. We are also happy to announce that the first candidate benefiting from the PREDIS mobility program will be hosted by a WP4 partner organization. Oher mobility activities are being planned and prepared and several MSc and PhD students have been recruited.



Pristine and oxidised SS316 coupons (top); oxidised and decontaminated coupons (bottom).

The metal waste decontamination activities are in full deployment. The preparation of oxidized metal coupons has been optimized for both stainless steel and Ni-alloys. The first decontamination tests using the CORD chemical treatment of oxidized coupons have started with very encouraging results.

Optimisation of the classification and characterisation of metallic waste is also advancing via the assessment of neutron calculations of several reactor materials. Concerning the reduction of uncertainties, the optimum parameters for non-destructive gamma spectrometry measurements were determined. Good agreement between simulation and gamma experimental measurements were found.

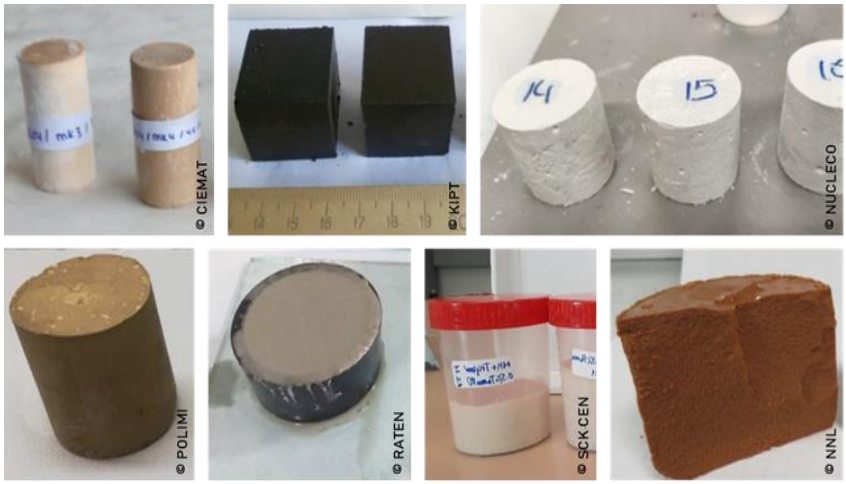
Studies on the encapsulation of reactive metallic wastes has achieved very good progress including formulation development (e.g., selection of an alternative Mg-source) as well as paste preparation conditions. The most sensitive factor affecting the MPC cost was identified, thereby allowing a cost reduction in the range of 15%. Testing of the optimized MPC matrices is ongoing.

WP4 lead: Abdesselam ABDELOUAS and Bernd GRAMBOW, Institut Mines Télécom Nantes Atlantique (IMT), FR

WP5: Innovations in liquid organic waste treatment and conditioning

The end of the first year of the PREDIS project sees the completion of the inventory of the radioactive liquid organic wastes (RLOWs) of interest to the Partners and End Users. Through a widely distributed questionnaire, more than 1 200 m^3 of RLOWs were inventoried – to the best possible knowledge of their characteristics – and categorized. The inventory is divided between oils (35%), solvents (25%), scintillation cocktails (20%) and decontamination liquids (20%). This information, gathered in the first deliverable published by WP5 (D5.1), confirms the partners' choices to focus their work on surrogate wastes representing "simple" oil, TBP/Dodecane solvents and scintillation cocktails.

Important experimental screening work was carried out to identify geopolymer formulations guaranteeing the best trade-off between high waste loading and good material properties, such as mechanical resistance or workability. Dozens of formulations have been tested at laboratory scale, spanning a wide range of raw materials: commercial products, locally sourced supplies or from recycled and recovered resources. The proposed formulations fall into three families of interest: (i) metakaolin-based, (ii) blast furnace slag-based and (iii) those based on original blends with recycled polymers. Some formulations resulting from these screening tests can already achieve waste loadings of 30 to 50 vol.%! The course of the collaborative approach will now target formulation optimisation and robustness checking.



Conditioning matrix samples from screening tests.

The three most promising formulations to date, belonging to the three families of interest, will be the subject of more in-depth characterisation. This includes evaluating their durability under various conditions, their resistance to irradiation and their thermal behavior.

WP5 lead: Maxime FOURNIER and David LAMBERTIN, Commissariat à l'énergie atomique et aux énergies alternatives (CEA), FR

WP6: Innovations in solid organic waste treatment and conditioning

During the last six months, considerable effort has been put forth to catch up with the delays and disruptions caused by the COVID-19 pandemic, which led to the imposition of almost no or very limited laboratory work depending on national sanitary regulations. Many achievements have now been realised and the first step was the treatment of waste surrogates and their characterizations prior to their immobilization. In order to compare several different processes and to identify crucial parameters, batches of sample materials were exchanged. CEA produced a batch of ash from the incineration of Ion Exchange Resins (IERs) for the development of a compaction process. A part of the same batch was sent to USFD for Hot Isostatic Press investigations and to POLIMI for immobilisation using geopolymers. Additionally, a Molten Salt Oxidation residue batch from CVRez was sent to SCK CEN and CSIC for optimisation of amenable geopolymer formulations. Process optimisation for the immobilization of treated wastes is currently the main challenge for many WP6 partners. For example, our Ukranian partners KIPT and SI IEG are working on the most promising matrix for the conditioning of wood ashes after incineration. In many cases, tests with cement-based materials are also conducted in parallel with geopolymer matrix development. Regarding innovative methods, USFD and POLIMI have demonstrated that IERs can be successfully degraded using Fenton-like processes. This approach is still under development and many runs were performed to stockpile enough materials before the immobilization step using HIP (USFD) or geopolymer binder (POLIMI).

Optimised, tuff-based geopolymer mortar mix with IER ash (POLIMI).

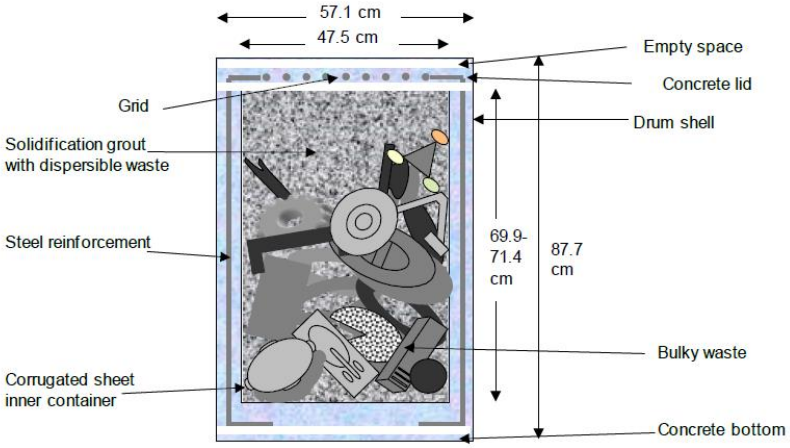
Whatever the matrix, once immobilized the physical and chemical durability of the conditioned wastes under the expected conditions prevailing in a final repository must be demonstrated. Considering the current national requirements for each partner and the proposition made in the EURAD-ACED program, a standard protocol has been established for short- and long-term experiments including, e.g., leachate composition and experimental conditions. The use of these protocols is not limited to WP6 but is encouraged to be used in WP4 (metallic wastes) and in WP5 (RLOW).

WP6 is still interested in collecting responses to the questionnaire sent to the End User community involved in PREDIS at the end of 2020 in order to establish waste inventory profiles. If your organisation owns, manages or produces radioactive wastes, please consider taking the time to fill out the questionnaire and share your information with us. Alternatively, the survey can be provided in pdf-format upon request.

WP6 lead: Thierry MENNECART, Studiecentrum voor Kernenergie / Centre d'Etude de l'Energie Nucléaire (SCK CEN), BE

WP7: Innovations in cemented waste monitoring

After completion of the state-of-the-art report (SOTA) on the monitoring of cemented wastes, it became clear that there is a multitude of waste forms. Many of the packages are cylindrical and basically consist of a protective drum containing the compacted waste, which is embedded in grout. However, several types exist and are in use, so a selection had to be made in order to identify the most common types that would be suitable as reference objects.



Schematic diagram of a cemented waste package showing dispersed and bulk waste in a 200 L steel drum (Wällisch, A. 2020. Paul Scherrer Institut, Villigen, Switzerland).

A new public milestone has been completed by project partner National Nuclear Laboratory (NNL) – "D7.2.2 Reference package and factors affecting package evolution and degradation" and is available on the PREDIS website.

In this report the collected data was used to derive a cemented waste package which would serve as a point of reference throughout the reminder of WP7. The document provides a high-level overview of the different mechanisms provided in the SoTA report which are of interest to the end users. It shows that volumetric expansion is a common degradation mechanism, which will lead to cracked cement matrices, enable corrosion and could possibly cause package deformation/cracking in particular circumstances. Details such as geometry, grout matrix and waste container material are provided. Reactive metals, in particular Magnox or magnesium metal, are presented as a proxy for actual waste, as they would cause a rapid degradation of the grout matrix and eventually the package.

With the help of this basic decision, WP7 now focusses on further advancing the planned technical work. The establishment of monitoring systems and the application of sensors are adapted to the chosen reference package. Initially, the expected range and type of measuring data must be investigated. Besides sensor development and data management efforts, work is ongoing regarding Digital Twin methodology, which is meant to provide models for the physical and chemical reactions taking place inside the waste containers. A first Digital Twin demo version has been developed by project partner PSI and is undergoing improvements. The platform can easily be accessed remotely and will soon be presented.

WP7 lead: Ernst NIEDERLEITHINGER and Christian KÖPP, Bundesanstalt Für Materialforschung und Prüfung (BAM), DE

PREDIS Project Officer and Partner Spotlights

In this 3rd newsletter we learn about our new EC Project Officer and partners from Greece, Lithuania, Norway and the UK.

PREDIS would like to officially welcome Dr. Seif Ben Hadj Hassine who is our new Policy and Scientific Programme Officer for Euratom. He joined the Euratom unit of the Directorate General Research and Innovation at the European Commission (DG RTD, Belgium) as a Policy and Scientific Programme Officer in January 2021 with responsibilities for radioactive waste management. He was first introduced at our consortium meeting in May 2021. Seif has worked for over 12 years in the decommissioning and radioactive waste management domain, including the past 6 years in the RD&D department of the Belgian waste management organization, ONDRAF/NIRAS. His PhD in Civil Engineering (2012) was on the development of a decontamination process for radioactive concrete structures, which was in collaboration between CEA of Marcoule, the Université of Toulouse and the French company Bouygues Construction. He has done a postdoctoral fellowship at the French TSO, IRSN.

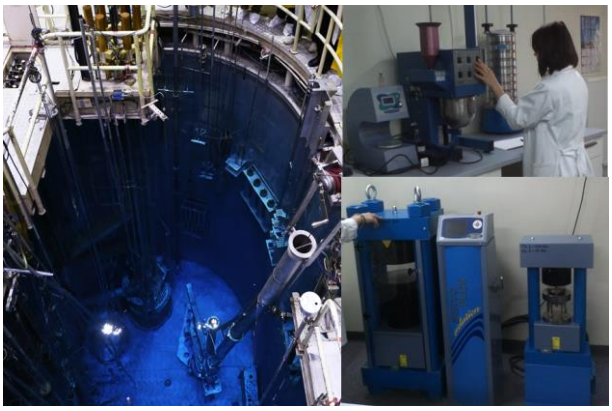
"I have been assigned as Project Officer of the PREDIS project since I joined the European Commission in January earlier this year. During this first year since it was launched in September 2020, the PREDIS project has been off to a good start and has reached the expected milestones and submitted the first deliverables with no major delays. In particular, the Gap Analysis and the baseline for the Strategic Research Agenda were finalized. Additionally, the PREDIS project has organized throughout the year a number of virtual open webinars with high quality content and large attendance from the RWM community. These webinars and workshops have strongly contributed to the steady involvement of the stakeholders and to the dissemination of knowledge, all the more so during the COVID-19 pandemic context we experienced. During the next year, the PREDIS project will undoubtedly make further progress on the technical programme and I am looking forward to attending in person the annual workshop next year in Berlin."

National Centre for Scientific Research "Demokritos" (NCSRD, Greece) is the largest multidisciplinary Research Centre in Greece with approximately 200 Researchers in tenure and tenure-track positions and over 500 Research Personnel. The organization is supervised by the General Secretariat of Research and Technology under the Ministry of Economy and Development of Greece. The Centre consists of five independent institutes focusing on different scientific fields: 1) Institute of Nuclear & Radiological Sciences and Technology, Energy & Safety (INRASTES), 2) Institute of Nuclear and Particle Physics (INPP), 3) Institute of Nanoscience and Nanotechnology (INN), 4) Institute of Biosciences & Applications (IBA) and 5) Institute of Informatics & Telecommunications (IIT). INRASTES operates the Greek Research Reactor (GRR-1) and the Centralized Facility in Greece for interim storage of radioactive waste and sources. INRASTES possesses significant experience in decommissioning and radioactive waste management including the radiological characterization of waste and facilities by destructive and non-destructive techniques and will contribute to WP4 regarding the optimisation of metallic waste characterisation and procedures for waste minimisation and recycling.

Valstybinis Moksliniu Tyrimu Institutas/Center for Physical Sciences and Technology (FTMC, Lithuania) is the largest scientific research institution in Lithuania and performs unique fundamental research and technological development in optoelectronics, nuclear physics, organic chemistry, bio and nanotechnologies, electrochemical material science, functional materials, electronics, etc. FTMC focuses not only on innovative science, but also the needs of business and society. The work of the Department of Nuclear Research at FTMC covers smart-environmental and environment-safe nuclear fuel cycle technologies, materials science and analysis methods. Theoretical and experimental methods for the safe operation of nuclear facilities, radiation safety and optimization of radioactive waste management as well as theoretical and experimental research on the interaction of radioactive waste with different barriers and shielding materials, degradation of engineering barriers in waste repositories and assessment of radionuclide accumulation and migration in the environment are areas of specific interest. FTMC is contributing to WP4 in tasks on the classification of waste streams in different types of reactors (T4.5.1) and the characterisation and sorting of metallic wastes in different management routes (T4.5.2).

The Institute for Energy Technology (IFE, Norway) is an independent research organization with locations in Kjeller and Halden, Norway. IFE is a leading technology development and research provider in the energy, environmental, petroleum and nuclear sectors. IFE also hosts the OECD Halden Human-Technology-Organisation (OECD Halden HTO) project (a continuation of the OECD Halden Reactor Project), which is a 60-year long international research collaboration under the umbrella of the Nuclear Energy Agency (NEA) supported by more than 100 organisations from 21 OECD member countries. IFE provides direct support to industry by facilitating digital transformation of work processes with a specific focus on safety critical and hazardous environments. This includes assistance to projects ensuring safety at challenging sites, such as the Chernobyl Nuclear Power Plant in Ukraine. Within the field of nuclear decommissioning, IFE was the first organisation designated by the International Atomic Energy Agency (IAEA) as an International Collaborating Centre. The work program of this centre involves development of digitalisation for knowledge management and is implemented through joint research and knowledge sharing events, specifically the DigiDecom workshop and training series organized in collaboration with the IAEA, NEA and other partners since 2017. IFE is also a founding member of the DECOM Cluster for Decommissioning and Repurposing and the Cluster for Applied AI, which are both key to IFE's role in the PREDIS project. IFE's Halden Virtual Reality Centre (HVRC) and the HADRON (Hazard Aware Digitalisation and Robotics for the Nuclear and other domains) laboratory will also support developments in the PREDIS project. IFE's main role in the project is prototyping and demonstrating a digital decision framework supporting informed decision making in the pre-disposal activities of radioactive waste. This decision framework will be based on the 3D digital platforms IFE has been developing for many years powered by digital twin, 3D radiological hazard modelling and visualisation, data analysis, optimisation, eXtended Reality (XR) and other advanced technologies.

The Institute for Nuclear Research Pitesti (RATEN ICN, Romania) is a subsidiary of the Technologies for Nuclear Energy State Owned Company (RATEN), a strategic Romanian legal entity coordinating the R&D activity in the nuclear energy field, which maintains and develops the scientific and technological support for the National Nuclear Energy Programme. RATEN ICN is an R&D centre created in 1971 whose activity covers a wide range of nuclear fields such as radioactive waste management, radioprotection, nuclear safety, nuclear fuel and materials and reactor physics. The research activity is founded on a modern and complex infrastructure consisting of the TRIGA reactor, Hot Cells Facility, Radioactive Waste Treatment Department, radiochemical and spectrometric laboratories featuring the latest investigation techniques as well as the significant experience of specialists in the nuclear field. Under the Radioactive Waste Management R&D program, financed by the Ministry of Energy, RATEN ICN specialists are developing treatment and conditioning technologies for LLW/ILW, establishing and applying new methodologies for radioactive waste characterization, and supporting the implementation of disposal programmes in Romania. On January 17, 2020 IAEA designated the Institute for Nuclear Research Pitesti as an International Centre based on Research Reactor (ICERR) in the field of "Education and Training" and "Common Research and Development Projects". RATEN ICN is contributing mainly to WP4 and WP5 in PREDIS with studies dedicated to aluminium encapsulation in magnesium phosphate cement-based matrices and organic liquid waste conditioning in geopolymer matrices based on blast furnace slag and Romanian volcanic tuff. RATEN ICN is coordinating the subtask dedicated to steel corrosion in contact with magnesium phosphate cements (T4.6.6) and the task dedicated to study the direct conditioning process of organic liquid radioactive waste in geopolymers (T5.3).

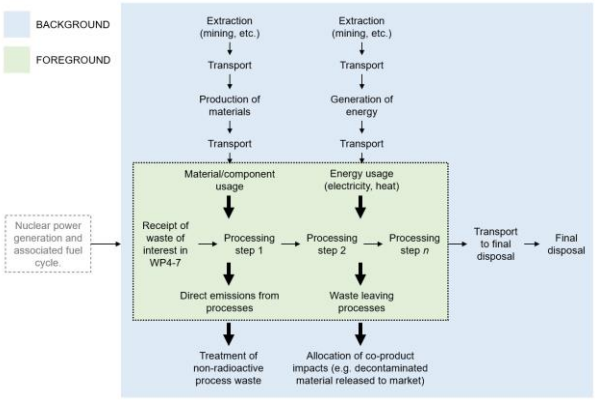


Galson Sciences Limited (GSL, UK) provides a range of research, management and consultancy services to an international clientele in the area of radioactive waste management and nuclear decommissioning. We help clients take decisions by informing technology option selection and by obtaining approvals for selected management options. The company undertakes multi-attribute studies covering all aspects of radioactive waste inventories and waste conditioning, packaging, transport, storage and disposal. We have particular expertise in preparing disposal safety cases for all kinds of radioactive waste, environmental safety cases for decommissioning, research on pre-disposal management options for "problematic" radioactive wastes, criticality safety assessment and lifecycle cost assessment. We have extensive experience developing and reviewing nuclear waste management and decommissioning programmes, including facilitating workshops and providing advice on stakeholder engagement. GSL is contributing its expertise to all of the PREDIS technical work packages (WP2, WP3, WP4, WP5, WP6, and WP7). We are producing metallic and organic waste inventories, providing guidance on waste acceptance criteria and management of secondary wastes, and conducting strategic assessments. Through this work GSL is helping end users and interested stakeholders to understand the strategic importance and potential application of the research being done in PREDIS.

The National Nuclear Laboratory Limited (NNL, UK) is the UK's leading nuclear technology services provider and can offer customers an unrivalled breadth of technical expertise, services and facilities covering all areas of the nuclear industry. NNL is a UK Government owned company employing around 1000 highly qualified experts in a variety of scientific and technical disciplines at six locations around the country. Our services encompass the complete nuclear fuel cycle, from fuel manufacture and power generation, through to fuel recycling, waste treatment, decommissioning and disposal. With four world-leading laboratories in the North West of England, we have a unique set of capabilities that enable ground-breaking nuclear Research and Development. We channel our work into four strategic areas: Clean Energy, Health and

Nuclear Medicine, Environmental Restoration and Security & Non-Proliferation. These four Focus Areas are the cornerstones of our ambition, shaping what we deliver to our customers, for society, and how we invest in our future. NNL is playing a significant role within the PREDIS project. We are part of the Management Team, contributing to the overall leadership of the project. NNL is also leading Work Package 2, delivering a range of activities including the development of the Strategic Research Agenda for predisposal. Additionally, NNL are applying our expertise in experimental research in metallic decontamination within Work Package 4; our significant experience in encapsulation to assess the use of geopolymer formulations for liquid organic waste encapsulation within Work Package 5; and delivery of Hot Isostatic Press (HIP) trials within Work Package 6. Finally, we are applying our expertise in robotics and artificial intelligence (AI) to Work Package 7, building on our work on previous Horizon 2020 project research and our experience supporting UK nuclear operations.

The University of Manchester (UMAN, UK) is a higher education and research institution, employing over 12,000 staff and educating approximately 27,500 undergraduate students and 12,500 postgraduate students. In the Academic Ranking of World Universities, The University of Manchester is ranked 6th in the UK and 8th in Europe. In research, funding totals £368M with 83% of that research being ranked as world leading. The University is home to the Dalton Nuclear Institute, established in 2005 with the aim to take a leading role in co-ordinating nuclear science and engineering research across the UK, and to play an active part in international collaborations. It is now the UK's largest and most connected academic provider of nuclear R&D and high-level skills development, winning over £100M research funding from research councils, industry and the UK Government since its inception. Manchester is also home to the Sustainable Industrial Systems research group, an internationally leading team which identifies sustainable solutions for industrial systems on a life cycle basis, taking into account economic, environmental and social aspects within the energy, chemicals, construction, food & drink, and transport sectors. In PREDIS, Dr Laurence Stamford and two PhD researchers – Rachael Clayton and Joel Kirk – are working in WP2 to estimate the life cycle environmental and economic impacts of PREDIS technologies, ultimately providing insights for the strategic research direction of future waste treatment development.



The University of Sheffield (USFD, UK) is a higher education and research organization with approximately 8,500 employees, 19,000 undergraduate and 10,500 postgraduate students, with an annual budget of ca. £640M. The university was founded in 1905 and ranks in the top ten UK universities, with >93% of research assessed as internationally leading. The Department of Materials Science and Engineering is one of the largest centres for materials research in the UK, internationally recognised for its research excellence. Within the Department, the Immobilisation Science Laboratory (ISL) is the largest academic R&D group in the UK focused on radioactive waste management and disposal, with 9 academic staff, 15 research associates and 32 PhD candidates. Our EPSRC funded HADES and PLEIADES laboratories are

equipped with glove boxes, processing, and analytical instrumentation for materials chemistry using radioactive materials, and are accessible as part of the UK National Nuclear User Facility. The research group hosts a regional facility for X-ray absorption spectroscopy as well as complementary laboratory instrumentation and programmatic synchrotron beamline access, which are open for collaboration. The research competency of ISL includes design, fabrication and performance assessment of radioactive wasteforms, the interaction of engineered and natural barrier systems, and thermodynamic modelling of materials alteration. The ISL has supported national waste management organisations and disposal authorities (e.g., Sellafield Ltd, Nuclear Decommissioning Authority, Radioactive Waste Management Ltd) in the conditioning, packaging and disposability assessment of radioactive wastes. USFD are participating in WP5 and WP6, particularly contributing towards research in geopolymer encapsulation of liquid organic wastes, organic treatment via Fenton wet oxidation, and Hot Isostatic Pressing of solid organic wastes, along with assessing the characterisation and durability aspects of processed waste forms. For further details of our research infrastructure, see The HADES Facility for High Activity Decommissioning Engineering & Science: part of the UK National Nuclear User Facility, N C Hyatt et al, IOP Conf. Ser.: Mater. Sci. Eng. 818 012022, 2020; https://doi.org/10.1088/1757-899X/818/1/012022 .

Key Upcoming Events

Please see our website for a full listing of PREDIS project events. and other event of interest to the PREDIS community.

PREDIS Project Webinar Series

The PREDIS project will continue to host free webinars to share insights and innovations from the work packages, hear from our industrial partners, and discuss priorities, challenges and outlooks in the predisposal management of radioactive waste. Register here for upcoming webinars!

- November 25, 9-12 CET: Knowledge Management
- January-February 2022 (time/date TBD): Digital Twins in the Radioactive Waste Management Domain

PREDIS Consortium Meeting, online (December 3, 2021)

Registration is open.

PREDIS Annual Workshop, in Berlin, Germany hosted by WP7 leader BAM (April 25-27, 2022)

Part of the event will be open to stakeholders. Stay tuned to the PREDIS website for registration and agenda details.

IGD-TP Symposium, Zurich, Switzerland (January 11-13, 2022)

The PREDIS project will be represented; presentations will be given from PREDIS perspectives. The symposium will be held in a hybrid format with both in-person and virtual attendance.

EURADWASTE'22 Conference and SNETP Event, Lyon, France, (30 May - June 4, 2022)

The PREDIS project will be represented; presentations will be given from PREDIS perspectives.

Newsletter #4

Be on the lookout for PREDIS Newsletter #4 in spring 2022!

Recent Publications

Project Deliverables and Milestones

In the past few months PREDIS has produced a variety of public documents that are hopefully of interest to the wider community. Take a look at the PREDIS "dissemination" web page or download here:

Deliverable 2.2 – Technological Gap Analysis, WP2 (published 31.5.2021)

Deliverable 3.6 – Priority List and Mobility Formats available for partners, WP3 (31.5.2021)

Deliverable 2.4 – International Approaches to Establishing a Waste Acceptance System, WP2 (31.8.2021)

Deliverable 1.5 – Proceedings of PREDIS May Workshop 2021, WP1 (30.9.2021)

Milestone 2.11 – LCA and LCC Protocol Guidance, WP2 (16.8.2021)

Milestone 2.3 – Baseline Strategic Research Agenda (SRA) on Predisposal topics, WP2 (20.8.2021)

Milestone 7.2.2 – Reference Package and Factors Affecting Package Evolution and Degradation, WP7 (31.8.2021)

Scientific Journals

"Fenton-like treatment for reduction of simulated carbon-14 spent resin, " M.A. Hafeez, J. Jeon, S. Hong, N. Hyatt, J. Heo, W. Um, Journal of Environmental Chemical Engineering (2021), 9-1, https://doi.org/10.1016/j.jece.2020.104740 (WP6).

"Stability of $SrCO_3$ within composite Portland-slag cement blends," S.A. Walling, L.J. Gardner, D.P. Prentice, M.C. Dixon Wilkins, A.A. Hammad, W. Um, N.C. Hyatt, Submitted (WP6).

Other

PREDIS has also contributed to joint publications with the European Joint Program on Radioactive Waste Management (EURAD):

EURAD Theme 2 Overview: Predisposal Activities prior to Geological Disposal of Waste (20.9.2021)

EURAD/PREDIS Joint Statement on Knowledge Management (11.10.2021)

Recent Webinars

The PREDIS project hosted five webinars from April to October 2021. Three were held in order to disseminate outcomes from WP2 (Strategic Studies) and examine topics of interest in more detail. The two others delved into technical aspects of waste characterisation and geopolymers in radioactive waste management which are topics of interest across all of our technical work packages as well as to the greater predisposal community.

- April 21, 9-12 CET: Waste Acceptance Criteria (WAC) 1 – Information and Resources
- May 20, 9-12 CET: Waste Acceptance Criteria (WAC) 2 – Needs, Challenges and Opportunities
- September 1, 13-16 CET: PREDIS Gap Analysis and defining the baseline Strategic Research Agenda
- October 5, 9-12 CET: Radioactive Waste Characterisation
- October 26, 9-12 CET: Geopolymers in Radioactive Waste Management

The presentations and summaries from these webinars are available on the PREDIS website (https://predis-h2020.eu/events/).