International Conference on
The Safety of Radioactive Waste Management, Decommissioning, Environmental Protection and Remediation

Ensuring Safety and Enabling Sustainability

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Advancing Sustainability Practices Through Innovation in LILW Pre-Disposal Radioactive Waste Management: Outcomes from the Euratom PREDIS Project

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PREDIS – “Predisposal management of radioactive waste” project scope

• To develop predisposal activities on treatment and conditioning methodologies
  → use of new materials and processes, evaluated also with life-cycle assessment (environmental and economics)

• To develop monitoring techniques of cemented waste and to implement digitalization
  → avoiding construction of new storage on sites
  → safer, cheaper or more effective alternative processes

Duration: September 2020-August 2024
PREDIS to share knowledge by fostering cooperation

- EU project with 47 Partners
- 17 European Countries
- 23.7 M€ investment (14 M€ EC)
- Strategic Research Agenda (SRA)
- Knowledge Management
- EURAD EJP cooperation
  → SRA and Roadmap of radwaste management

16 public webinars
28 public reports, so-far

Over 35 students
Over 20 mobilities

https://predis-h2020.eu
PREDIS context of EURAD Roadmap

Roadmap is a key document for access to current knowledge

- Theme overviews,
- Domain Insights,
- State-of-Knowledge

See https://www.ejp-eurad.eu/roadmap
Uptake of the project results

• PREDIS End User Group with 24 organisations
  • Nuclear power plant operators and research reactor owners
  • Radioactive waste producers (RWP) & waste owners
  • Waste management organisations (WMOs)
• Contribution to initial Gap Analysis and SRA
• Sharing during PREDIS workshops & webinars
• Sharing of data, materials, modeling scenarios, case studies, value assessment report; hosting technology demonstrations
• Additional 175 Stakeholders from 33 countries worldwide who follow project activities (newsletters, public events)

(see additional PREDIS paper/presentation by Elke Jacops, SCK CEN)
Providing guidance and support

- Insights for process development and strategic decision making
- **Focus on waste hierarchy to support sustainable practices**
- Waste acceptance criteria (WAC)
  - Practical guidance for qualification across MS
  - Report on international approaches to establishing waste acceptance system
- Life cycle assessment and cost (LCA/LCC)
  - Development of new models for comparing material and process/treatment choices

*(see additional PREDIS paper/presentation by Kirk, Clayton, Stamford (Univ. of Manchester) and Banford (NNL))"
Metallic waste treatment and conditioning

• Research highlights
  • Creation of datasheets for metal treatment and decontamination technologies
  • Performing of decontamination tests with chemical solutions and gel technology
  • Secondary waste treatment focusing on electrochemical behaviour of ionic liquids
  • Characterization and sorting of metallic waste in different management routes

• Impacts
  • Improving problematic metallic waste management routes safer and more economically efficient
  • Decontamination of Ni-alloys (from EDF steam generator), demonstrating potential for material free-release or varying deposition waste class
  • Reduction of waste management and disposal cost, minimisation of volumes and increased waste incorporation rates
Treatment and conditioning of liquid organic waste (RLOW)

- Research highlights
  - Three reference geopolymer matrix formulations have been identified as candidates for direct conditioning solutions
  - Robustness and optimization studies performed
  - The target is to develop geopolymer formulations that could be scalable to different countries in Europe by using local raw materials

- Impacts
  - Developed treatment and conditioning process TRL 6 (prototype verified)
  - Demonstrated performances of the final waste materials in long-term storage and disposal conditions allowing to assess disposability.
  - A shared view of predisposal solutions translated into management strategies applied at national or European scales.

Nevastane EP100 oil as RLOW surrogate (30% vol.) could be easily incorporated without surfactant.
Innovations for treatment and conditioning of solid organic waste

Target is to demonstrate reliability of alkaline binders for conditioning of residues and secondary wastes and verify the matrix performance of conditioned waste

- **Research highlights**
  - Substantially higher loading (more than 90% volume reduction) into the geopolymer without loss of matrix strength or cohesion with gasification and immobilization in a novel metakaolin geopolymer
  - Successful design and development of geopolymer and cement matrices to immobilize residues

- **Impacts**
  - Increasing the confidence of the thermal treatment based on secondary waste subsequent solidification / immobilisation and hence the long-term stability of the reconditioned wastes
  - Increasing the disposability, volume reduction and cost of waste treatment and storage

Top: Metakaolin geopolymer prisms; Bottom: Alkali-activated Blast furnace slag prisms; both with 10 wt% salt & converted by Ca(OH)$_2$. 
Concrete waste packages – monitoring and digitalisation

Research Highlights

- Identification, evaluating and developing various radiation detection tools for radwaste characterization and monitoring
- Adapting and demonstrating digital twin technology and digital decision framework

Impacts

- Demonstration of more versatile and reliable condition monitoring technologies, which are made available to end users
- Improved accuracy in predicting the behaviour of waste/packages in storages, increased safety for personnel and environment and reduced cost (avoiding need for retreatment or repackaging)
Summary and way forward

- Fourth and final project year on-going until August 2024
- Final Conference in Avignon, France, 3-7 June 2024 (public!), hosted by CEA and VTT (travel via Marseille air or train)
- Interested parties are always welcome to join the Stakeholders Group to receive information https://predis-h2020.eu/end-user-group/
- Consortium of 47 partners develop techniques for improved predisposal management of metallic, RLOW and RSOW and cemented waste packages
- Support to strategic research and knowledge management – download over 50 relevant documents!
Looking ahead to EURAD-2

- EURAD-2 proposal to be submitted 8 November 2023
- Joint Programming will fulfil expectations of end-users
  - Help Member States in their timely implementation of RWM activities
  - Joint research work creates new knowledge, educates scientists and broadens capabilities
  - Existing knowledge is made available & accessible in an efficient manner
  - Trust and mutual understanding exists between the partners

- Added value of and step change with PREDIS is recognised: follow-up programme on RWM with integration of EURAD-1 programme
- Starting October 2024, 5 year duration
Acknowledgements

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More information: https://predis-h2020.eu

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