

JRC infrastructure for RWM research: is there something in for me?

*EURAD-2 Webinar on European Infrastructure
Needs for Radioactive Waste Management,
09/03/2026*

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Short outline (*... for short presentation*)

- ✓ Context : Joint Research Centre
- ✓ RWM Research at JRC
- ✓ Open Access program
- ✓ Some alternatives





Signing of the Treaties of Rome, 25 March 1957 :

- Treaty of the European Economic Community (EEC)
- Treaty of the European Atomic Energy Community (**EURATOM**)

→ Art.8 : R&D tasks to be carried out by a "Joint Research Centre"



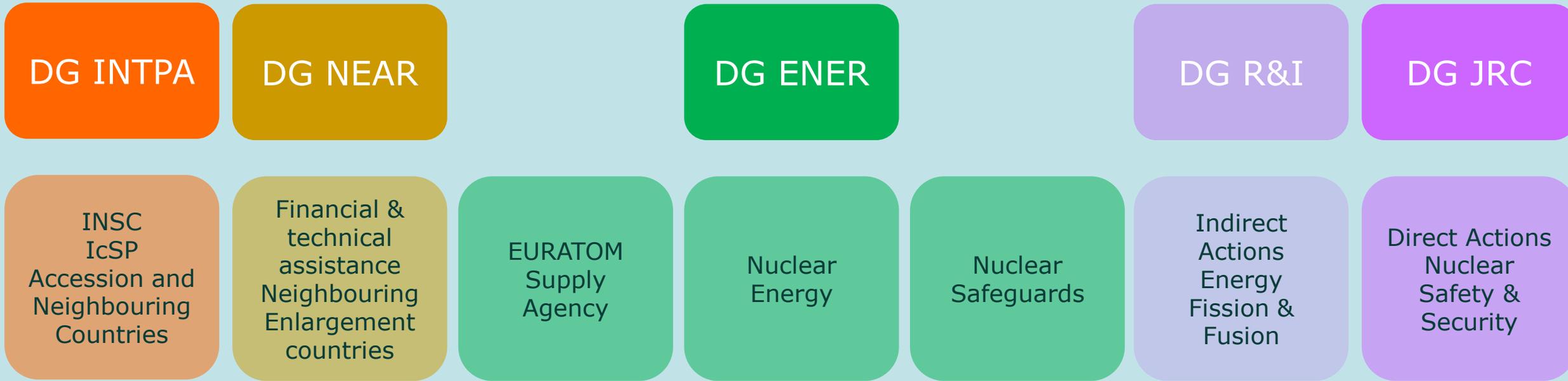
"...the Commission shall establish a Joint Nuclear Research Centre"



External Support

Policy & Legal

Research



The “Raison d’être” of EURATOM R&T is to

- help MSs develop solutions jointly for possible common use,
- together we can ensure synergies and effectiveness between all actors,
- coordinated (non-competitive) R&D on open science seems more effective,
- cutting-edge science, knowledge transfer between MSs and provisions of next generations of scientists should be the best way for EURATOM R&T sustainability.

EURATOM Research & Training



EURATOM R&T Programme - Activities

Radioactive Waste Management

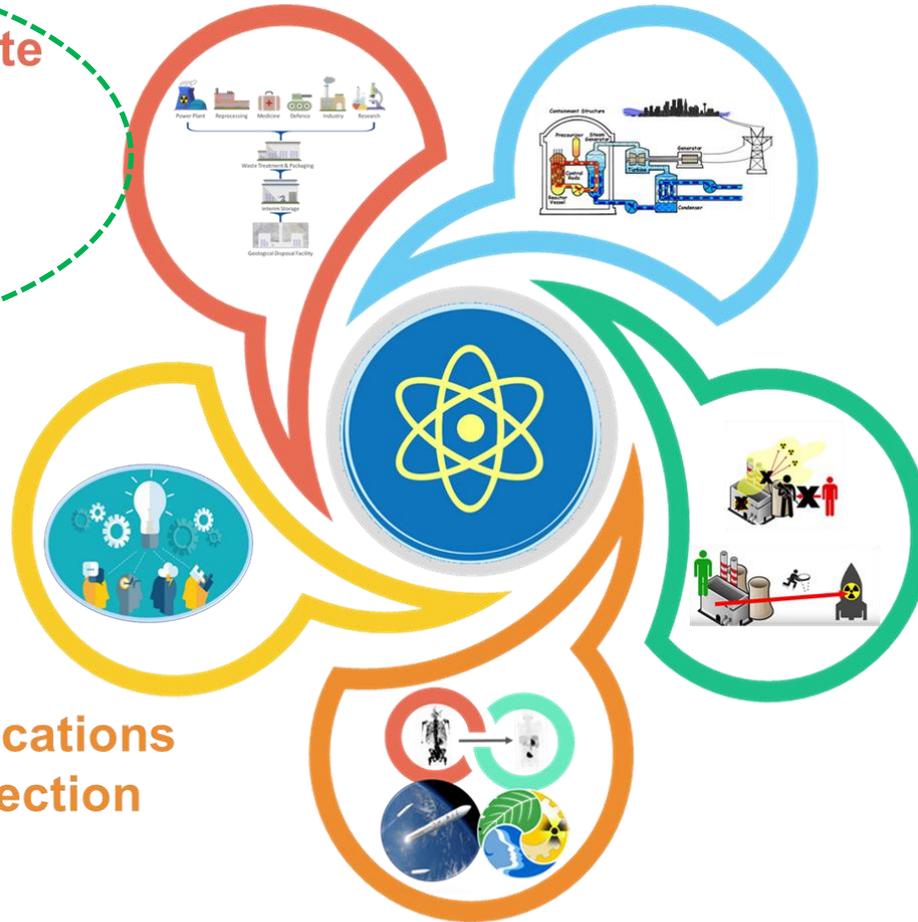
Deep Geological Disposal
Extended Interim Storage
New Waste Forms (ATF, SMR)
Regulatory framework
E&T, KM, Open Access

Nuclear Knowledge & Competence

Maintain Competence (E&T)
Human Resources Observatory
Support JRC Open Access
Reference Data & Standardization
Innovation & Technology
from Research to Industry

Non-power Applications & Radiation Protection

Medicine, Environment, Space
EU beating Cancer
Standardization
Accelerators
Open access, E&T



Nuclear Safety of Nuclear Power Plants

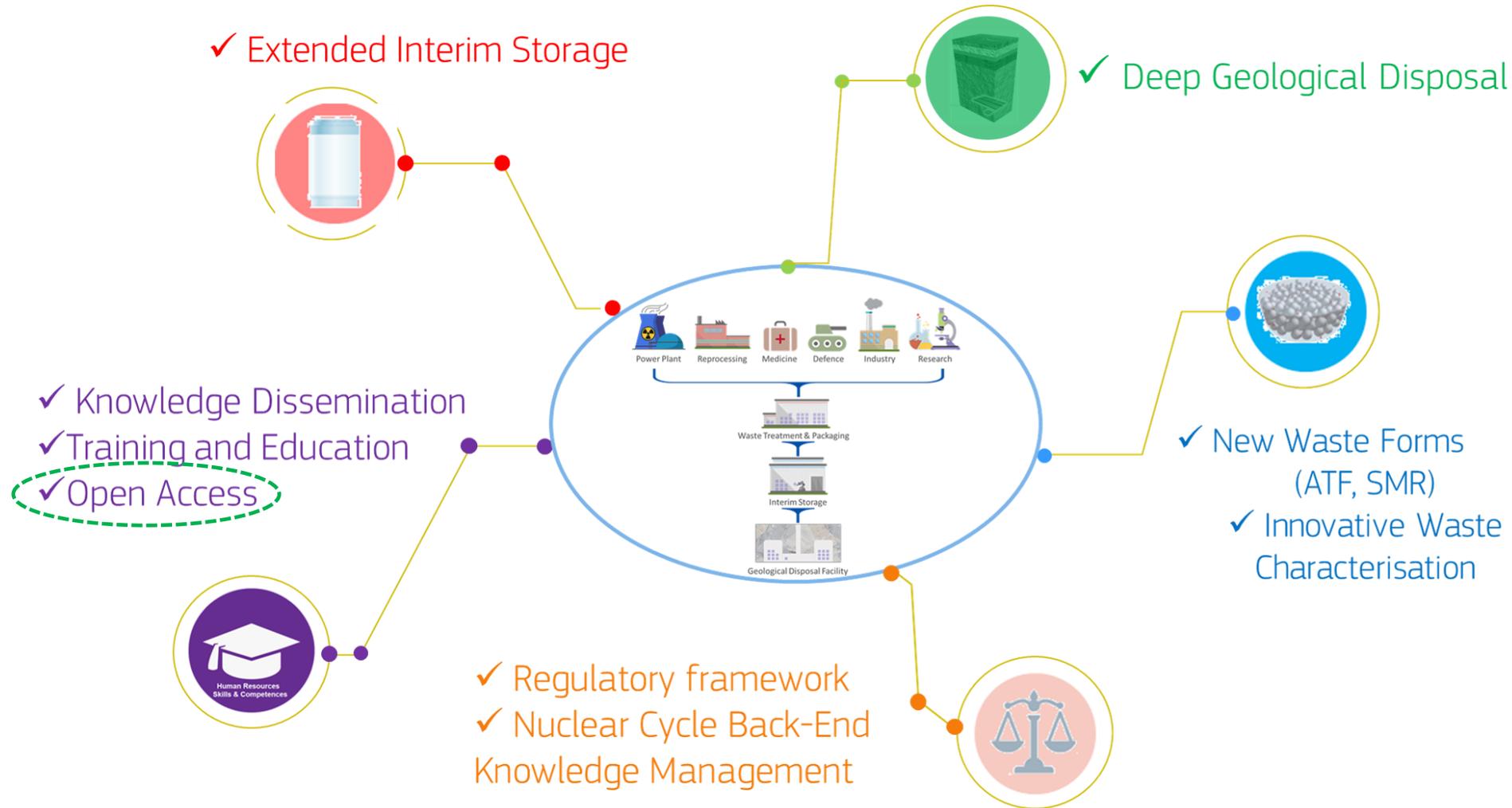
Nuclear reactor safety
Update of safety regulations
LTO, SMR, Gen-IV
Innovative materials
Fuel development and testing
Infrastructures: JHR, HFR and Open Access
Emergency Preparedness

Nuclear Safeguards and Security

EU Safeguards obligations
EU nuclear non-proliferation
Synergies with Security Union & Defense
International Partnership
E&T, KM



Objectives and activities RAW Management



Open Access to JRC Research Infrastructures

Use the JRC Labs for Research

The European Commission's Joint Research Centre (JRC) opens its scientific laboratories and facilities to people working in academia and research organisations, industry, [small and medium enterprises \(SMEs\)](#), and more in general to the public and private sector.

The JRC offers access to its non-nuclear facilities to researchers and scientists from EU Member States and countries associated to the EU Research Programme Horizon Europe. For nuclear facilities, the JRC opens to EU Member States and to countries associated to the Euratom Research Programme. International organisations are also eligible under specific conditions as detailed in the call for proposals.

About Open access project

Framework for access

Offering access to visiting researchers is part of JRC's strategy to

- enhance dissemination of scientific knowledge
- boost competitiveness
- bridge the gap between research and industry
- provide training and capacity building

Scientists will have the opportunity to work in the following fields

- nuclear safety and security (Euratom Laboratories)

Stay informed of future calls by
[subscribing to the JRC newsletter](#)

Joint Research Centre (JRC) - Newsletter

The Joint Research Centre provides independent, evidence-based knowledge and science, supporting EU policies to positively impact society

Science for policy

Latest updates



Open access to JRC Research Infrastructures

Based on the [Charter of Access to RIs of DG RTD](#)

Principles and guidelines when defining access policies for RIs

Open to EU MS and countries associated to Horizon Europe or Euratom (for nuclear research infrastructure)

RELEVANCE-DRIVEN MODE



Peer-reviewed selection process



Targeted to Academia, Research Institutions and SMEs



Users are charged the associate additional costs (free for nuclear)



Open dissemination of data after an embargo period

MARKET-DRIVEN MODE



Selection by the JRC



Targeted to Industry



Users are charged the full costs



Data not disseminated



The nuclear research infrastructures open access scheme of the Joint Research Centre (JRC) at the European Commission – Contributions to education, training, mobility and scientific excellence - ScienceDirect



☞ JRC-Karlsruhe (Germany)

- **PAMEC:** Properties of actinide materials under extreme conditions
- **FMR:** Fuel and materials research
- **HC-KA:** Hot cells
- **SSL:** Surface Science Lab (*JRC-KA => Prague*)

☞ JRC-Geel (Belgium)

- **GELINA:** Neutron time-of-flight for high resolution neutron measurements
- **MONNET:** Tandem accelerator based fast neutron source
- **RADMET:** Radionuclide metrology laboratories
- **HADES:** Underground laboratory for ultra-low level gamma-ray spectrometry

Hot Cells - KA: unique infrastructure + unique library of irradiated samples

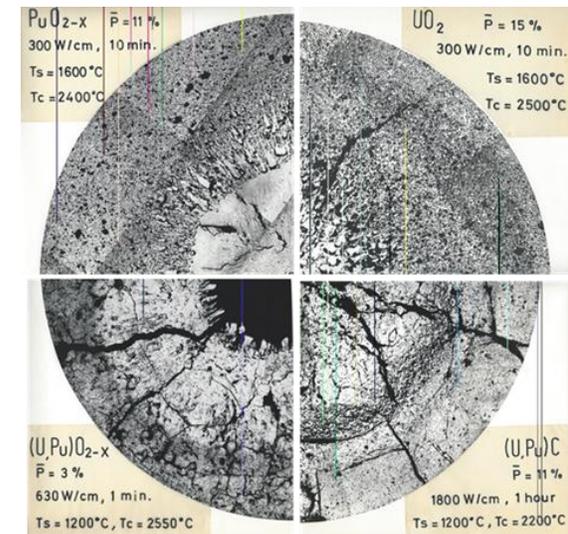


For 60 years JRC KA took part in many research programs on irradiated fuels

⇒ More than 4200 individual samples

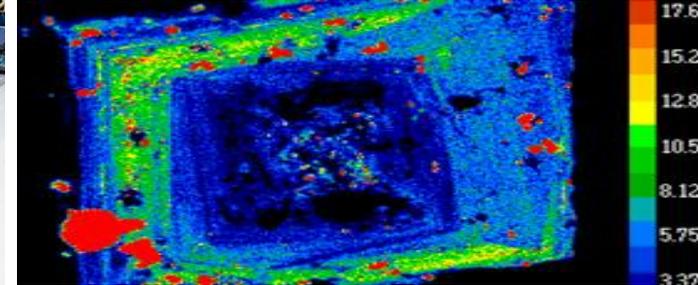
⇒ 542 experimental conditions (reactor, burn up, fuel matrix, isotope composition)

Fuel Matrix	Actinides and/or dopant	Reactor	Burn up
Oxides Nitride Carbide Carbo-nitride Metal	$U+Pu$ ($\frac{Pu}{U+Pu}$ 10-45%) from U_{nat} to highly enriched Np, Am, Cm Additives Gd, Cr	HFR PHENIX RAPSODIE FR2 DFR SILOE BR2 HALDEN KNKII	From 0.5% to 13% FIMA



JRC Open Access facilities – some examples

Neutron beams
to explore
the femtoscale
(MONNET)



Fuels and Materials
Research
Laboratory (FMR)

JRC ultra low-
background
gamma-ray
spectrometry
facility (HADES)



JRC neutron
time-of-flight
facility (GELINA)

Liquid Lead
Laboratory
(LILLA)



Hot-Cell
Laboratory
(HC-KA)

(besides Open Access) **Joined activities, bilateral collaborations:
sharing infrastructure for common goals**



Successful example of MS support at JRC

Collaboration with ENRESA



20 YEARS OF COLLABORATION

Access to JRC laboratories and **hot cells** that are unique in Europe

10 researchers **trained**, 7 continued their career in the radioactive waste sector

Participation in the **Euratom** Research on Spent Fuel

Scientific excellence through >10 papers and >20 conferences



Summary of what we (can) offer

Supporting MS with expertise, infrastructure, and trusted scientific evidence

- ✓ Ensure **open access to unique infrastructure** (ActUsLab (Karlsruhe), SSL (Prague), EUFRAT (Geel), EMMA (Petten))
- ✓ Foster strong **international collaborations** with key partners such as **ENRESA, CIEMAT, CEA, ARSN, KIT, SCK-CEN, CRIEPI, JAEA, OECD-NEA, IAEA...** enhancing scientific impact and global alignment.
- ✓ Offer **advanced training opportunities**, sharing our knowledge and experimental capabilities to educate and mentor young researchers across Europe.
- ✓ **Support EU Member States and international organisations** by delivering **independent, high-quality data** and technical expertise for policy and regulatory needs.



Thank you

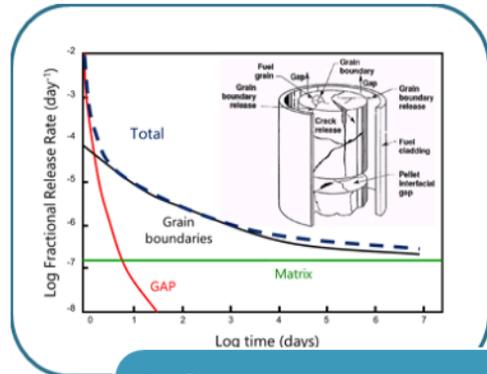


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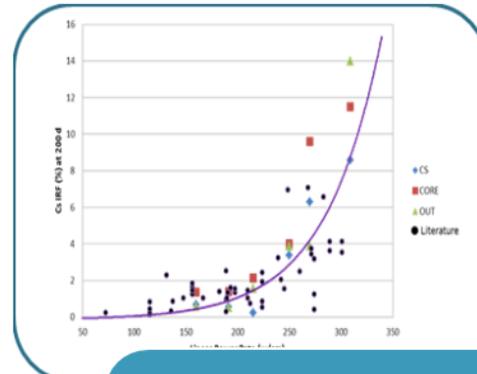


Some examples of relevant results (1): SNF stability under relevant disposal conditions



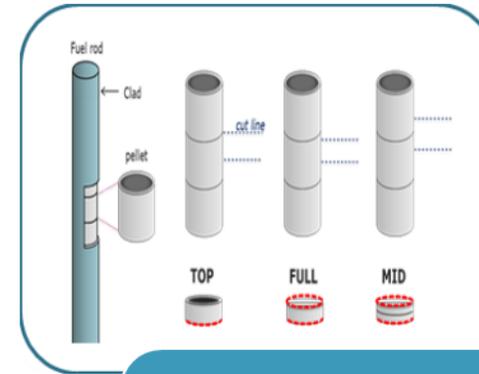
Safety assessment

- Reduce uncertainties
- Extend experimental database
- Improve Modelling



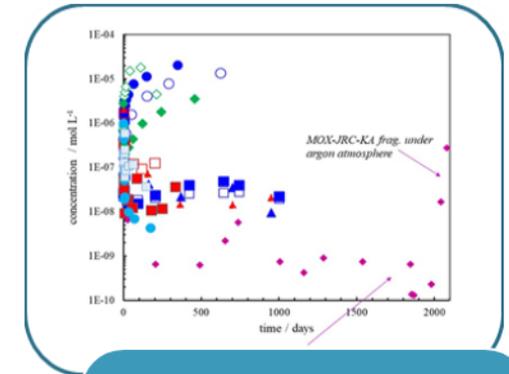
Correlation between IRF and irradiation history

- Linear Power Rating as the main factor affecting IRF
- Driving force for the relocation of some Rn to the void spaces



Sample representativeness

- Radial effect: HBU protective effect
- Positive dishing effect on IRF
- Longitudinal effect: local irradiation differences



Long-term stability

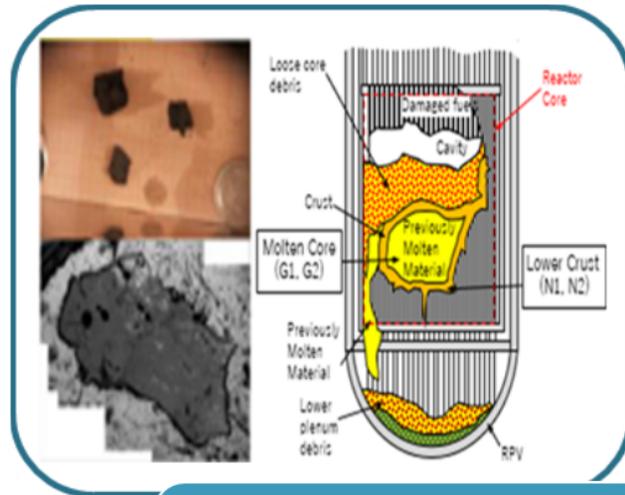
- Long-term matrix dissolution studies under strong reducing conditions
- High stability of SNF. Inhibition of matrix dissolution. Reduction to U(IV)

Reducing uncertainties on the short-, mid- and long-term aqueous release of SNF is a key factor in safety assessment of the radionuclide waste repositories



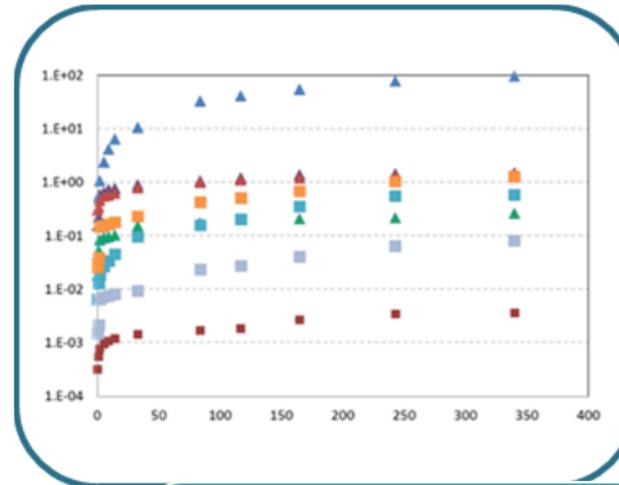
Some examples of relevant results (2): Stability of corium and damaged fuel

Post-accidental water-cooling scenarios



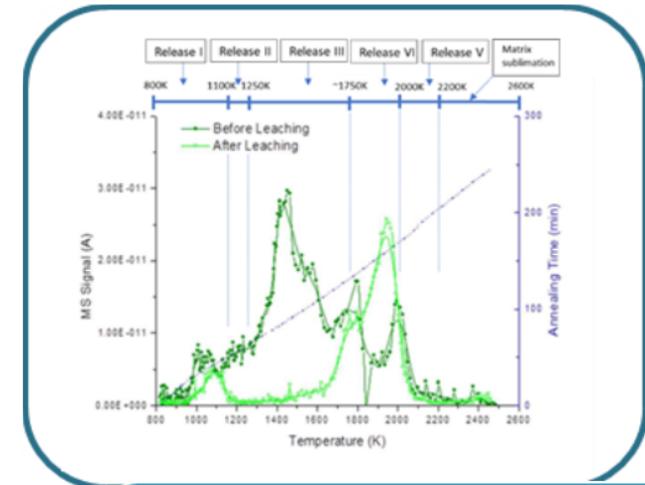
Post-accidental scenarios

- Understanding aqueous solubility of corium and damaged fuel
- JRC-Karlsruhe unique inventory: TMI, Chernobyl and Phebus samples



Corium aqueous stability

- First ever made leaching experiments with genuine TMI corium samples
- Analogies with SNF
- Experimental data base too limited



Modelling

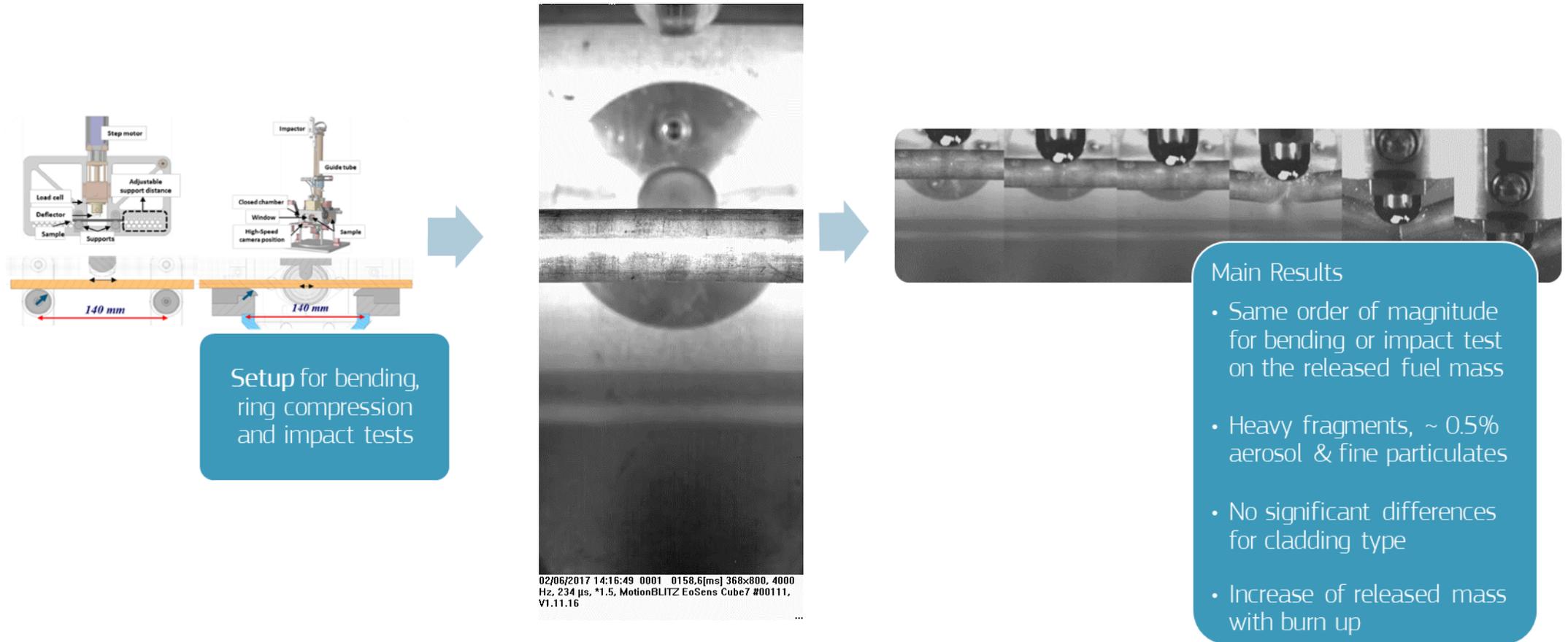
- New modeling approaches are being investigated
- Coupling with KEMS to interpret Rn source term

Quantification of the **water/corium** interaction in terms of fission product and actinide releases in aqueous phase allows the adoption of **realistic post-accidental management strategies**

Some examples of relevant results (3):

Spent nuclear fuel characterisation for safety assessments

Safety analysis of spent nuclear fuel rods under accidental loading conditions

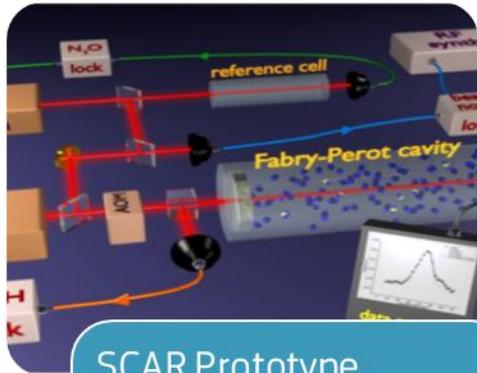


Scientific basis for establishing regulatory and licensing requirements and guidelines which affect spent nuclear fuel transportation, extended interim storage and retrieval thereafter



Some examples of relevant results (4): Innovative Analytical Methods

Saturated Absorption Cavity Ring-down (SCAR) spectroscopy – C-14



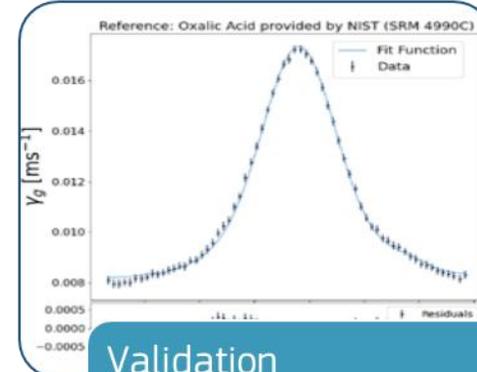
SCAR Prototype

- Granted Exploratory Research Project 2018
- Collaboration with INO-CNR (Florence)
- DTM radionuclides



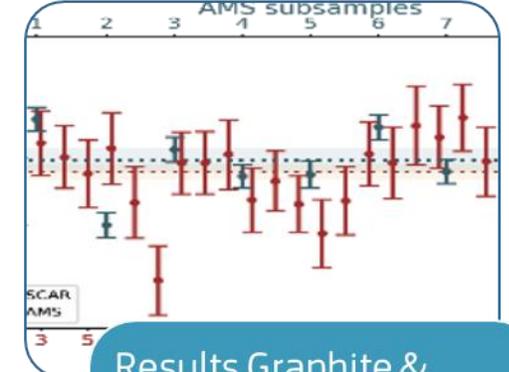
SCAR Experimental Setup

- Experimental setup commissioned for C-14 determination
- Coupled to a carbon extraction system operating in a radiation controlled environment



Validation

- Method validation against reference standard materials



Results Graphite & Concrete

- SCAR and AMS have comparable results.
- SCAR has a much larger dynamic range, making it more applicable to the nuclear field than AMS

The precise and accurate determination of the radionuclide inventory in radioactive waste streams is a key aspect in establishing the best suited nuclear waste management and disposal options



Some examples of relevant results (5):

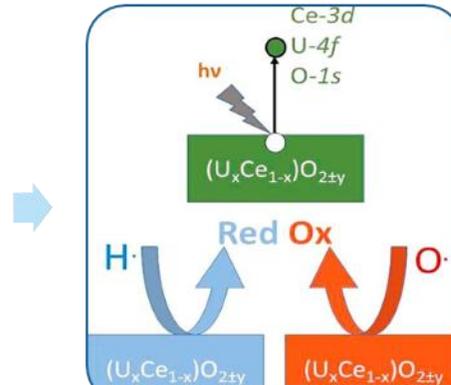
Basic mechanisms underlying corrosion phenomena

State of the art surface science preparation and characterisation set-up for separate effect investigations



'LabStation'

- Modular set-up
- Model systems: Thin Films (TF)
- XPS/UPS, BIS, LEED, HREELS, AFM/KPFM, TPD
- Open access facility



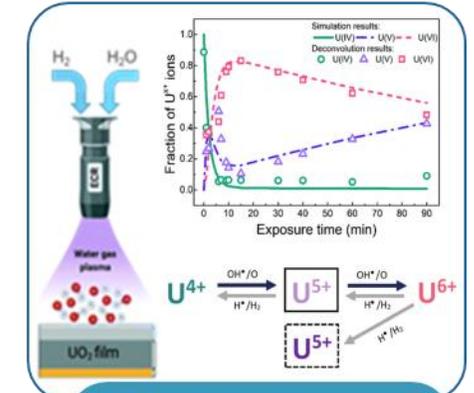
High flexibility

- actinide oxide TF (U, Th, Np and div. MOX) are produced and reacted in-situ with
- water (adsorbed ice layers)
- highly reactive atomic species H_{atom} , O_{atom}
- redox interaction in mixed oxides is evaluated



ECR water plasma source at LabStation

- products similar to those from radiolysis of liquid water.
- no dissolution and precipitation of secondary phases



Recent results

- Strong evidence for an oxidation/reduction mechanism via U(V).
- impact of mixed H_2O/H_2 plasma of variable composition

Models for NWD safety assessment need **underpinning** research data to build sufficient confidence in the safety case. Knowledge building is facilitated by Open access to research infrastructures..



JRC sites

Headquarters in **Brussels**
and research facilities located
in **5 Member States:**

Belgium (Geel)

Germany (Karlsruhe)

Italy (Ispra)

The Netherlands (Petten)

Spain (Seville)

