



# FIRST-Nuclides News

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## Website FIRST-Nuclides:

[www.firstnuclides.eu](http://www.firstnuclides.eu)

## Newsletter submitting organization:

Amphos 21  
Passeig Garcia i Fària 49-51  
E08019 Barcelona,  
Spain



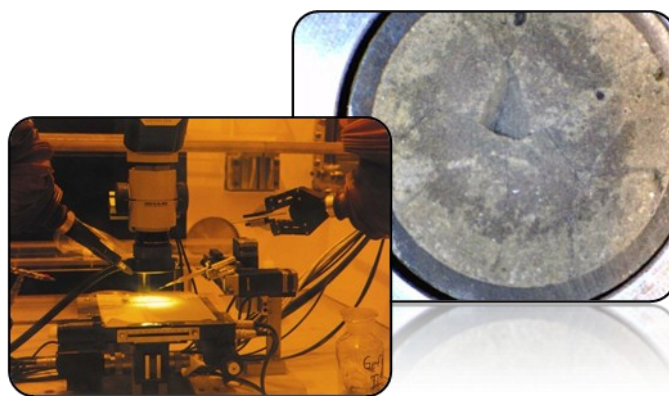
## About FIRST-Nuclides

The Collaborative Project “Fast / Instant Release of Safety Relevant Radionuclides from Spent Nuclear Fuel (FIRST-Nuclides)” started in January 2012 and extends over three years. It falls within the European EURATOM (European Atomic Energy Community) program and is implemented within the European Commission's 7<sup>th</sup> Framework Program.

The project consortium consists of 10 Beneficiaries, 6 End User Members from National Waste Management Organizations and 11 Associated Groups.

The overall objective of the FIRST-Nuclides project is to provide for improved understanding of the fast / instantly released radionuclides from disposed high burn-up UO<sub>2</sub> spent nuclear fuel.

*Coordinator: Bernhard Kienzler and Volker Metz (Karlsruhe Institute of Technology, KIT)  
Scientific-Technical Secretariat: Lara Duro and Alba Valls (Amphos 21)*



## 2<sup>nd</sup> Annual Newsletter

The objective of the Annual Newsletters is to inform the project beneficiaries and the broader community on the progress achieved within the FIRST-Nuclides project.

This edition falls together with the 1<sup>st</sup> Periodic Activity and Management Report.

The 2<sup>nd</sup> Annual Newsletter provides a brief description of the current status

of each workpackage. Sources where information of interest for the project can be found is provided.

The last news of the second project year are reported.

In the news section, the main issues related with the project such as training activities, next events, etc. are addressed.

## Workpackage status

### • **WP1: Samples and tools**

All workpackage participants collected theoretical and experimental data on various UO<sub>2</sub> HBU-SNF materials, which were available for subsequent studies within the project. Based on these data, certain HBU-SNF materials were selected for detailed characterization and preparation of samples for experimental studies.

The selected fuels were BWR and PWR SNF with burn-up in the range of 42-70 GWd/tHM. A wide variety of techniques have been used to study these materials. Some examples are:

- \* JRC-ITU: Non Destructive Testing (e.g.  $\gamma$ -scanning, profilometry or defect determination)
- \* PSI: XRF, XANES and XAS



Fuel rod segment  
at the shielded  
box-line of KIT

### • **WP2: Gas release + rim and grain boundaries diffusion**

Different studies have been carried out to experimentally determine the release of fission gases from the fuel. JRC-ITU measured FG release from PWR fuels and KIT conducted puncturing tests to analyse the plenum gases. Gas from corrosion leaching experiments were also sampled. STUDSVIK has used Laser-Ablation Mass Spectroscopy to determine the radial fission product

distribution (e.g. Xe, I and Cs).

Investigations on rim and grain boundary diffusion is done by JRC-ITU, JÜLICH and CNRS. Some experiments are:

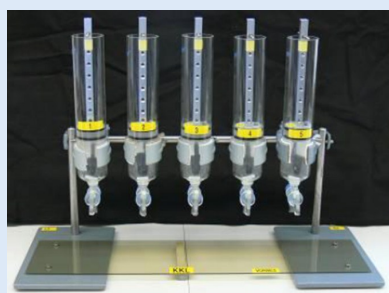
- \* Determination of <sup>85</sup>Kr and <sup>14</sup>CO<sub>2</sub> after cracking of the tight coatings.
- \* Elemental mapping of SF samples what revealed a high accumulation of Xe and Cs outside the fuel-kernel

### • **WP3: Dissolution based release**

Seven partners are working to improve the knowledge on FP release. PSI experiments are focused on the determination of the redox state and the distribution pattern of Se, Cs and I. The team from SCK-CEN is preparing leaching experiments to determine the IRF from Belgian SNF. Dissolution rates for different isotopes and uranium using the activity concentration data from long term (1-4 years) wet storage of damaged and leaking fuel

were determined by MTA-EK. STUDSVIK started leaching experiment with the aim of exploring the effects of additives and dopants on the fast/instant release of fission products such as Cs and I and investigating the feasibility of measuring fast/instant release of Se and <sup>14</sup>C.

Methods to determine <sup>14</sup>C, <sup>129</sup>I, <sup>90</sup>Sr and <sup>79</sup>Se have been developed by KIT, JRC-ITU and CTM.



Experimental setup used  
by PSI and SCK-CEN in  
the experiments of spent  
fuel leaching,

#### List of acronyms

BWR: Boiling Water Reactor  
FGR: Fission Gas Release  
FP: Fission Product  
HBU-SNF: High Burn-Up Spent Nuclear Fuel  
IRF: Instant Release Fraction

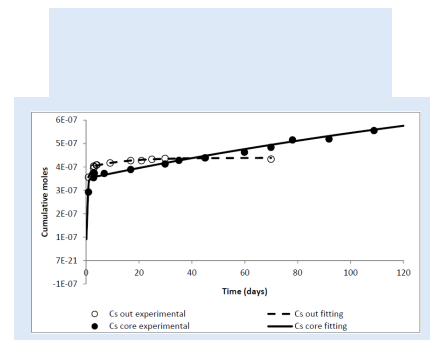
PWR: Pressurized Water Reactor  
XRF: X-Ray Fluorescence  
XANES: X-ray Absorption Near Edge Structure  
XAS: X-ray Absorption Spectra

## • WP4: Modelling

Experimental data from different SNF burn-ups and obtained from several experimental setups have been collected for modelling.

KIT has determined the initial and boundary conditions needed for further modelling tasks calculating the burn-up and decay history, the rim zone burn-up, the rim zone thickness and the porosity of the rim zone.

UPC-CTM developed a semi-empirical model for IRF based on different contributions related to both availability to water and chemical characteristics. AMPHOS 21 has conducted a complete review of the different models used for describing FGR, and has developed a complex model to account for the water saturation of the SNF pellet.



Modelling of caesium release (CTM-UPC)

## • WP5: Knowledge, reporting and training

The project webpage, the organization of annual workshops and the distribution of newsletters are the main activities aimed at disseminating the knowledge generated during the

project. A training course has been organized by KIT, JRC-ITU and AMPHOS21. Three PhD students were awarded with a training mobility funded by the project to attend the training.

## Last News & Events

- The **first periodic report** has been submitted to the commission by end of august. The final periodic report will be submitted at the end of the project.
- The **first workshop proceedings** are available from the project website
- The **lab exchange meeting** was held at PSI facilities with the aim of discussing analytical and technical issues for the experimental work with the spent nuclear fuel samples.
- A **Training Course** aiming at teaching young scientist from beneficiary or AG institutions on spent nuclear fuel /hot cell facilities was organized by KIT/INE, JRC -ITU and AMPHOS 21. It was held at KIT/JRC-ITU facilities (9-10<sup>th</sup> July 2013). The global punctuation given by the attendees was 4.7 over 5 due to the quality of the lectures and laboratory visits and the excellent organization.
- **Training mobilities:** Two of the three foreseen training mobilities have been successfully completed.
  - \* **Albert Martínez (CTM):** 25<sup>th</sup> February to 9<sup>th</sup> March 2013 (KIT/INE)  
*Study of the effect of  $\alpha$ -radiolysis on  $UO_2(s)$  grain / matrix dissolution, using  $^{238}Pu$  as  $\alpha$ -emitter, at low and high ionic strength under alkaline conditions.*
  - \* **Péter Szabo (MTA):** 8-19<sup>th</sup> July 2013 (KIT/INE)  
*Specific training on hot-cell work and experimentation with spent nuclear fuel samples.*
- The **2<sup>nd</sup> Annual Workshop** will be held in Antwerp (Belgium), 5-7<sup>th</sup> November 2013. It will be hosted by SCK-CEN. The main outcome of the workshop is the proceedings with contributions describing the technical work performed during the second project year.



Visit to KIT/INE hot cell laboratories during the training course organised in July 2013

# Find at [www.firstnuclides.eu](http://www.firstnuclides.eu)

## General Information

General information: project organization, topics of interest, activities in the frame of the project, etc.

## Technical Information

Detailed information on the work performed in each workpackage and results obtained during the first year of the project :

- \* 1st Annual Proceedings
- \* Deliverables submitted to the EC

## Events & Training activities

Information regarding the forthcoming events and training activities.

## Interested? Questions? Comments?

Please, do not hesitate to contact the coordination team for specific information:

[info@firstnuclides.eu](mailto:info@firstnuclides.eu)

## FIRS-Nuclides participants

The institutions/organizations involved in the project and its activities can be divided into: beneficiaries, end-users-group (EUG) and associated groups (AG).

