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# LWR-DEPUTY

(Contract Number: 036421)

## PROJECT PRESENTATION

Author(s): M. Verwerft

Reporting period: e.g. 01/10/2007 – 01/04/2007

Date of issue of this report : 03/05/2007

Start date of project : 01/10/2006

Duration : 48 Months

<b>Project co-funded by the European Commission under the Euratom Research and Training Programme on Nuclear Energy within the Sixth Framework Programme (2002-2006)</b>		
<b>Dissemination Level</b>		
<b>PU</b>	Public	X
<b>RE</b>	Restricted to a group specified by the partners of the [LWR-DEPUTY]	
<b>CO</b>	Confidential, only for partners of the [LWR-DEPUTY] project	

[LWR-DEPUTY]





## **Introduction**

The basic idea behind LWR-DEPUTY is that it is part of a portfolio of projects devoted to decrease the burden of nuclear waste. The project fits in such a portfolio by studying in an experimental way the development, behavior and in-pile performance of novel fuels for deep burning of plutonium in existing nuclear power plants (NPPs) and to what extent the existing NPPs in Europe can create markedly less nuclear waste by moving to inert matrix fuels.

### **1 Nature and Scope of the project**

• LWR-DEPUTY intends to build upon the experience gained in 5th Framework Programme (FP5) projects on advanced nuclear fuel. The project is active on two experimental axes as well as a cross-cutting theoretical activity:

- Fabrication and irradiation of four "ceramic-in-metal" (CERMET) PuO<sub>2</sub> containing fuel pins in a Materials Test Reactor.
- Thoria based fuels that have successfully been irradiated in earlier projects are subject to in-depth post-irradiation examination, radiochemical and back-end studies of the fuel cycle.
- An assessment is made of the efforts needed to introduce novel fuel concepts in existing NPPs. Performance and safety assessment of thoria based fuels is also made and code benchmarking is performed using experimental data from radiochemical analysis of thoria based fuels.

• The Consortium for LWR-DEPUTY is presented below. Together they have the expertise (codes, knowledge and know-how) and resources (fuel fabrication facilities, Materials Test Reactor, dedicated laboratories to handle irradiated material) to carry out the project.

### **2 Activities**

The general goal of LWR-DEPUTY is to step forward in introducing in existing light water reactors innovative fuels dedicated to Pu management and burning, and reducing the production of minor actinides. We would like to achieve major steps forward by:

- Demonstrating the fabrication of two metal-based Inert Matrix Fuels and their compliance with LWR environment at BOL
- Establishing a data package of critical radionuclides in irradiated thoria based MOX fuel
- Generating a data package serving as starting point for licensing Inert Matrix Fuels in LWR's.



### 3. Expected Results

#### *Screening irradiation of novel Inert Matrix Fuels in LWR conditions*

The objective is to irradiate several reprocessible CERMET fuels in conditions compatible with LWR conditions. Four CERMET fuel pins loaded with PuO<sub>2</sub> are fabricated by two partners of the consortium, ITU and NRG. The metallic matrices are of two types: two ferritic (Fe-Cr) matrices, and two Mo matrices (preferably depleted Mo). For each type, the PuO<sub>2</sub> will be inserted as large and small precipitates, this microstructure difference allowing to address the stability of the fuel under irradiation.

A screening irradiation will be performed in BR2 material test reactor at Mol (BE) under LWR conditions of pressure, temperature and water chemistry. Intermediate examinations will study the performance of the fuel segments, specially their mechanical stability. The final destructive examination of the fuels is deferred to outside the duration of the LWR-DEPUTY project.

#### *Post-irradiation Examination, radiochemical investigations and back-end studies on selected fuel samples*

The main objective of this Work Package is to create an experimental database on the basis of which a benchmark exercise could be defined. The focus will lie on the actinide inventory of plutonium loaded, thorium based fuel. It will allow fuel modellers to test, validate and compare different calculation codes that are applied. A comparison of theoretical with experimental data should lead to a better understanding of the burn-up behaviour of (Th,Pu)O<sub>2</sub> fuels in Light Water Reactors. Such knowledge underpins the in-reactor fuel performance of these fuels and has its impact on all related aspects (burn-up behaviour, safety issues, etc.).

#### *Fuel performance evaluation and validation of methodologies and codes*

The introduction of innovative fuels in Nuclear Power Plants requires detailed feasibility studies and reliable layout for introduction into reactor cores. Preliminary numerical analyses in this field, performed within the 5th FP projects, show promising safety features and transmutation-performance of novel fuels. Many outstanding issues related to reactor safety, burn-up behaviour and fuel performance under operating conditions will be dealt with in this project. The accuracy of numeric analyses and methods will be proved by simulation of irradiation experiments and benchmarking, basing on the results from Post-Irradiation Examinations and radiochemical analyses.





4. **Societal Impact**

LWR-DEPUTY builds further upon research performed in FP5. The partners are convinced that this is a viable way to ensure continuity and build strong European competence in nuclear science and technology. In complex, strongly regulated and expensive fields like nuclear fuel technology, one *must* build upon past research. In doing so, LWR-DEPUTY contributes to construct ERA, the European Research Area. The involvement of training activities in the different work packages of LWR-DEPUTY varies according to the type of work executed in each of the Work Packages. LWR-DEPUTY is to a certain degree a backbone research and development project upon which Master thesis work, PhD and post-doctoral research is grafted, rather than be entirely embedded in.

5. **Information about important public events** (0-5 lines)

None to be reported for the moment.

6. **Project Website address & contact person** (2-5 lines)

Project website: <http://www.sckcen.be/LWRDEPUTY/>

Contact Person: dr. Marc Verwerft





## LWR-DEPUTY

### List of partners

FZ-Jülich  
 FZ-Karlsruhe  
 FZ-Rossendorf  
 Joint Research Centre (Institute for Transuranium Elements)  
 Nexia Solutions  
 Nuclear Research and consultancy Group (NRG)  
 Paul Scherrer Institute  
 Studie Centrum voor Kernenergie/Centre d'Etude de l'énergie Nucléaire (SCK•CEN)  
 VUJE Inc.

### Coordination

Dr. M. Verwerft  
 SCK•CEN  
 FMA/NMS  
 Boeretang, 200  
 B-2400 Mol (Belgium)

### EC Project Officer

Mr. Ved BHATNAGAR  
 European Commission  
 DG RTD-J/4  
 Office: CDMA-1/046  
 B-1049 Brussel

Period :	MM	yyyy	-	MM	yyyy
	10	2006		09	2010

Budget : Total project cost (2 500 000€)  
 EC contribution (1 250 000€)

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PP -  
 Dissemination level :PU  
 Date of issue of this report : 03/05/2007

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Filename: LWR-DEPUTY PROJECT PRESENTATION\_format EC.doc  
Directory: N:\USERS\MVERWERF\My Documents\4\_D056\LWR-  
DEPUTY\Contract docs  
Template: C:\Documents and Settings\mverwerf\Application  
Data\Microsoft\Templates\Normal.dot  
Title: ® REPORT OR SPECIFIC DELIVERABLE  
Subject:  
Author: pascute  
Keywords:  
Comments:  
Creation Date: 5/3/2007 6:15:00 PM  
Change Number: 3  
Last Saved On: 9/4/2007 3:28:00 PM  
Last Saved By: mverwerf  
Last Printed On: 9/6/2007 9:23:00 AM  
As of Last Complete Printing  
Number of Pages: 5  
Number of Words: 1.030 (approx.)  
Number of Characters: 5.874 (approx.)