



Issue 1

R2CA Newsletter



15/06/2020

What's R2CA project?

R2CA is a 4-year project, initiated in September 2019, dedicated to the Reduction of Radiological Consequences of Accidents within design basis and design extension conditions. The project, coordinated by the "Institut de Radioprotection et de Sûreté Nucléaire", gathers 17 organizations from 11 countries at a cost of 4M€, 3.2M€ of which is financed by the European Commission.

Its main objectives are:

- The realistic evaluation of the radionuclide release during Loss Of Coolant Accidents (LOCA) and Steam Generator Tube Rupture (SGTR) through evaluation/reduction of possible conservatism used in safety analyses;
- The improvement of the accident management procedures, the development of innovative instrumentation and early diagnosis tools, the evaluation of promising Enhanced-Accident Tolerant Fuel (E-ATF),

in order to identify the means that can be used to reduce the radiological consequences of these accidents and increase the NPP safety.

New methodologies based on best estimate calculation schemes for assessing these accidents and evaluating the associated radionuclide releases will be proposed and tested on different types of generation II and III reactors (PWR, VVER, EPR, BWR).

N. Girault (IRSN)

First Kick-off Meeting

The First kick-off meeting of the European project R2CA was held in Fontenay-aux-Roses from 20 to 22 November 2019. It gathered about 40 European experts and allowed to converge on the first studies of interest to be launched.

On this occasion, the first advances were also shown mainly concerning the reviews of the methodologies used in different countries for evaluating the radionuclide releases, of the various simulation tools and calculation schemes that will be used during the project, and of the experimental data available for the analysis of the two transients of interest (LOCA & SGTR).

V. Busser (IRSN)



First project activities

The project activities have started by an initiation of reviews on methodologies and simulation tools currently used by R2CA partners for fission product release evaluation. In addition, was also launched the identification and collection in a database of available experimental tests which will be used to verify and validate the improvements of the corresponding tools in LOCA and SGTR bounding scenarios within DBA and DEC-A domains.

N. Girault (IRSN)

News from Task 2.1.1

Within the task 2.1.1, 6 partners (IRSN, TRACTEBEL, Bel V, SSTC-NRS, ARB, LEI) have shared their various methodologies to evaluate the radioactive release due to a LOCA, or a SGTR in a PWR, VVER or BWR.

Due to the very different context, regulatory practices and licensing procedures in the different countries, major differences in the methodologies are observed, leading to one to two orders of magnitude discrepancies for the radioactive releases of some major isotopes such as Xenon and Iodine.

In particular for LOCA conditions significant discrepancies have been noticed regarding the conservative deterministic assumptions used, not only on the number of failed fuel rods but also on the fission product behavior in the failed fuel rods, in the primary loop and containment.

This work will establish a first picture of the different methodologies.

It will be updated throughout the project enabling to evidence the improvements performed within the project in particular through the reduction of some of the conservatism.

J. J. Ingremeau (IRSN)

News from Task 2.1.2

In Task 2.1.2 of R2CA project, a review of simulation codes and calculations schemes for LOCA and SGTR is done. Analysis covers the capabilities of the available codes including both system codes and codes focusing on a part of the phenomenology, in particular the determination of the fuel rod failures as well as the consequences of the failures. In connection with Task 2.1.1, review and analysis of the combined use of these codes in implementation of the evaluation methodologies is carried out. Task 2.1.2 has 10 partners, and the selection of codes (more than 20) covers fuel performance (transient and normal operation), sub-channel and system thermal-hydraulics, radionuclides behavior and integral system behavior. While there exists a number of other codes for these kinds of analyses, the review focuses on the codes used in the R2CA project. The work of analyzing and comparing various codes and the interlinkage between the codes is done as follows.

First, a questionnaire chart was formulated, consisting of various models to be compared between the codes, with an emphasis on fission product behaviour. As there are codes with different modelling scales, the comparison of codes was divided into two spreadsheets: integral system codes, and fuel performance/radionuclides behaviour codes.

Secondly, short descriptions of the codes were written by the code owners or users. In addition to general overview of modelling capabilities, any possible interlinkages to other codes in the specific radiological consequences evaluation method are brought out, as well as how fission product release and transport is considered in the code, how data is passed in the calculation chain, what boundary conditions are needed, and how can a code use the output of another code with more detailed modelling as its input. Currently, a synthesis of further code development needs is under preparation, as well as an analysis of current modelling capabilities. **The deliverable report is scheduled for August 2020.**

A. Arkoma (VTT)

Meeting of Task 2.1.3

Topical meeting on “Task 2.1.3 Review of existing experimental database” was held on 15 January, 2020 in Budapest. During the meeting the available experiments were reviewed on:

- Fuel failure during LOCA and SGTR,
- Activity release from fuel during LOCA and SGTR,
- Activity transport during LOCA and SGTR.



(MTA EK burst test sample available in the database)

The parameters of matrices for LOCA and SGTR were identified for three categories: phenomena, test characterization and data availability. After the discussions more than forty experimental programs and NPP measurements were selected for review. The responsible organizations for each program were identified and they will produce the related chapters for the deliverable. The matrices will be filled and presented in the deliverable. The database will also include a large directory with individual subdirectories for each experimental program. The subdirectories will contain the available information and data on the given experiment.

fuel failure during LOCA		fuel failure during SGTR		activity release from fuel during LOCA				activity release from fuel during SGTR				activity transport during LOCA				activity transport during SGTR																					
cladding oxidation	ballooning and burst	brittle failure after heavy oxidation	water quench	fuel fragmentation and dispersal	secondary defect	brittle failure	hydrogen uptake by Zr	local hydriding of Zr clad	water logged fuel rod	noble gas release from the fuel rod - steady state	noble gas release from the fuel rod - transient	volatile fission product release from the fuel rod - transient	semi-volatile fission product release from the fuel rod - transient	fission product release from high burnup structure	noble gas release from the fuel rod - steady state	noble gas release from the fuel rod - transient	volatile fission product release from the fuel rod - transient	semi-volatile fission product release from the fuel rod - transient	leaching of fuel pellets by water	fission product release from high burnup structure	transport in the primary circuit (from core to break)	deposition in the primary circuit, retention by primary circuit components	transport in the containment	deposition on the containment wall	deposition in the containment sump	water	transport to the environment outside of containment	noble gas transport	volatile fission product (I, Cs)	semi-volatile fission product transport	transport in the primary circuit (from core to break)	deposition in the primary circuit, retention by primary circuit components	deposition in the steam generator, retention by steam generator	transport to the environment outside of containment	noble gas transport	volatile fission product (I, Cs) transport	semi-volatile fission product transport

(Parameters of the phenomena matrix)

The first draft of the deliverable with chapter titles and identified authors was sent out after the meeting by MTA EK. It was agreed that the contributions to the database review from R2CA partners will be delivered soon. After compilation of the chapters and editing the conclusions, the deliverable will be ready for review by R2CA participants during the summer period. **It is expected that the final version will be ready by the end of August, 2020.**

Z. Hòzer (MTA EK)

Meeting of Task 2.2

Within Work-Package 2, one of the final goals is to quantify the gains made in WP3 and WP4. In order to do this quantification a first reactor test case is performed in Task 2.3 and hereafter the same test case is reassessed in task 2.5 but including the improved simulation codes, schemes and/or models from WP3 & WP4. In order to start these reactor case simulations, task 2.2 collects a set of reactor configurations and accident scenarios. **During the Senior Expert Group meeting in November 2020** it was decided that different partners would all use their own specific models and/or modelling approaches. For every reactor type and accident, conference calls were held in order to discuss each other’s scenarios. **Those meetings lead to a final document that collects all scenarios and reactors which will be used for Task 2.3.**

P. Bradt (TRACTEBEL)

News from WP 6

In the framework of the WP6 the D6.1 “Communication Education & Training Action Plan (CETAP)” has been released. In relation to the planned communication activities, the R2CA project website is going to be finalized and will be continuously updated throughout the project duration; the design of material to support project dissemination and communication activities has been finalized and a project brochure and poster are available; social network accounts have been created in order to give a contribution to the public communication supporting the promotion of workshops, training activities, summer school and mobility program. Education and training needs have been collected through the Partners and a first list of mobility, master thesis and training sessions proposals is available.

The next 1st year progress meeting will be hosted by ENEA and is planned from October 13th to October 16th; a training session on SCIANTIX code, developed by POLIMI, is planned along the meeting. Considering the COVID-19 issues and the consequent restrictions, when more information will be available about what Partners are allowed and about local restrictions in that period, Partners will be informed if the meeting and the related training will be confirmed or eventually done remotely.

F. Mascari (ENEA)

R2CA End Users Group - EUG

To promote the diffusion of scientific results and of the harmonized methodology developed within the project, an End Users Group (EUG) has been created, open to safety authorities, technical support organizations, NPP owners, Vendors, thermal-hydraulics, fuel and source term experts, and Universities with curricula in nuclear reactor safety. EUG members may express their needs and opinions in the field of thermal-hydraulics, fuel and source term, will approach the methods developed during the project, will become familiar with them, and will present their approach to project results thus showing its exploitation. They will participate in the periodic workshops, training courses and summer school foreseen for the future. Interested parties are encouraged to contact the project Coordinator through email or the project website. Applications will be approved yearly by the project Steering Committee.

F. Rocchi (ENEA)

R2CA Members

17 Organizations
(11 Countries)

Duration

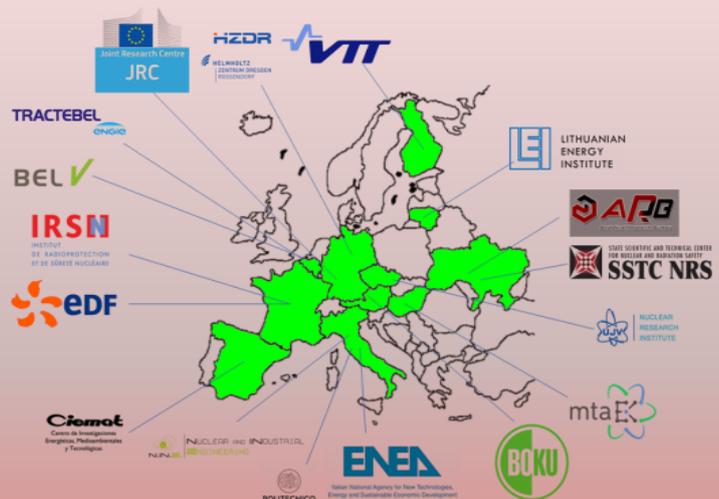
01.09.2019 – 31.08.2023

Commitment

522 person/months

Overall Budget

€ 4.2 M€ (~ ¼ funded by EU)



THE CONSORTIUM

IRSN

INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE



BELV



Ciemat

Centro de Investigaciones
Energéticas, Medioambientales
y Tecnológicas



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<https://r2ca-h2020.eu> (under testing)

www.linkedin.com/groups/12404880/

www.researchgate.net/project/R2CA-H2020-EURATOM-PROJECT

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