

SARNET NEWS N°8

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GENERAL INFORMATION AND PROJECT MANAGEMENT (*Thierry ALBIOL*)

The announcement of the second European Review-Meeting on Severe-Accident Research and management, **ERMSAR 2007** is available on the SARNET WEB sites. It will be **hosted by FzK in Karlsruhe** from **June 12 to June 14, 2007**. A provisional programme and practical information are also available on the SARNET WEB sites.

A draft paper entitled 'SARNET: Severe Accident Research Network of Excellence' by the SARNET Management Team has been accepted for the ICONE-15 conference, Nagoya, Japan, 22-26 April 2007.

The preparation of the SARNET Follow-up after the current European contract (i.e. from April 2008) is ongoing. A second meeting of the Working Group was held on November 6th in Garching. Following this meeting a second draft of what could become a new consortium agreement was prepared and a letter was sent to the European Commission. The answer to this letter lets open a follow up with a European Commission support for SARNET, nevertheless the EC insists on the need to "demonstrate clear signs of irreversible integration between core partners by the end of the project".

ASTEC (*Jean-Pierre VAN DORSSELAERE*)

The 26 partners answered the questionnaire on satisfaction on ASTEC V1 code set up by IRSN. The general opinion is good except for the code documentation that needs to be improved.

Since the June 06 ASTEC Users' Club, the partners have completed their assessment tasks done with the version ASTEC V1.2 rev1. Their detailed technical reports are being synthesised by the Topical Coordinator: synthesis of validation, synthesis of benchmarks on plant applications, and progress report on model adaptation to other reactors than PWR. For the latter work, collaboration is becoming more intensive between KTH and IKE on BWR, and between INR and AECL on CANDU.

IRSN and GRS have released the latest version ASTEC V1.3 to all partners in mid-December 2006. The main improvements are a still improved robustness and a more complete documentation, with a first version of Users Guidelines. The users should be able to extend in 2007 the applications to scenarios such as large break LOCA or Steam generator Tube Rupture.

PSA2 (level 2 Probabilistic Safety Assessment) ACTIVITIES (*Bernard CHAUMONT*)

The next partners meeting (January 23rd to 25th 2007 in PSI Villingen) is being actively prepared. Most important topics of this meeting will be the progress on harmonization of level 2 PSA methods and the development of dynamic reliability methods.

More precisely, recent progress concern:

- the document about the status of practices and guidelines in the EC for level 2 PSA development. The document, which synthesizes partners views on this subject, gives some interesting perspectives about the difficult question: Is harmonization of practices possible in the EC and how ? In parallel, a review of main international and US guides has been undertaken,
- the deliverable about harmonization of methods for hydrogen distribution and combustion, immediate consequences of vessel breach and associated uncertainties is now well advanced,

- first ideas about harmonization of methods to assess in a level 2 PSA melt corium and concrete interaction, and iodine releases have been derived from the comparison of partners approaches,
- a questionnaire has been prepared about definition of reactor "safe" or end states and first partners answers provided,
- also, the work has been initiated on two other themes of harmonization: definition of large early fission products releases (first partners contributions provided) and level 1 and level 2 PSA interface (questionnaire being prepared),
- most contributions of the first step (without uncertainties assessment) of the benchmark exercise to compare dynamic reliability methods and classical ones have been provided and a comparison has been undertaken while, in parallel, the second step (with uncertainty analysis) has been initiated,
- the development of the Stimuli Driven Theory of Probabilistic Dynamics is being pursued with the help of three mobility programmes recently started or proposed.

CORIUM (*Christophe JOURNEAU*)

Early phase of core degradation work package: WP9

VVER test QUENCH-12 successfully performed on September 12. It gives very interesting results regarding Zr1Nb cladding oxidation and hydrogen production in comparison to QUENCH-06 with Zircaloy-4 cladding.

Benchmark on boil-off test QUENCH-11. Calculation period ended end of 2006. First results were presented during the 12th Int. QUENCH Workshop (October 24-26).

New record for the QUENCH Workshop: 43 presentations within three days.

The Parameter test including top reflooding has been successfully performed on April 15, 2006 at Luch institute (ISTC program). Experimental data have been processed and qualified. They were made available to collaborators early July. The benchmarking of this test with the MAAP code has been done at EDF.

Three FZK presentations on QUENCH-10, air oxidation and oxidation modelling have been presented at the ANS Annual Meeting in Reno, NV, June 5-8. A FZK/IBRAE paper on B₄C oxidation has been accepted by NED. A FZK paper on air ingress has been published by NED.

An analytic experimental program at INR has started to study oxidation using a thermal balance. PSI has also joined this activity with a bibliographical review on oxidation under air.

Late phase core degradation and vessel behaviour: WP10

The last six months have been largely devoted to a calculation benchmark on the OLHF 1 test.

The objectives are as follows:

- improvement of predictability of time, mode and location of RPV failure;
- development of adequate models with the ultimate aim of being included into integral codes;
- interpretation/analysis of experiments with models/codes and sensitivity studies;
- better understanding of the breach opening process in order to characterize the corium release into the containment.

Different approaches are considered, namely a simplified model implemented recently into Astec/Icare-Cathare (IRSN) and viscoplasticity models implemented into the Cast3m (CEA), Ansys (FZD) and Code_Aster (EDF) finite element codes. Several failure criteria are considered, namely: stress, strain and damage evaluation criteria. The compilation of all the calculation results is in progress.

Ex-vessel corium recovery: WP11

Debris coolability

The Joint Activity on Debris Coolability was centred on the code WAABE from IKE. A workshop has been organized in August 2006 to transfer this code to KTH and VTT. The code has been applied to KTH DECOBI experiments. In parallel, an extended experimental program has been started at IKE.

Corium concrete interaction

In the field of MCCI, the main joint activity is Benchmark using the MCCI experiments COMET-L2 and L3 performed at FZK.

Blind calculations of COMET-L3 started in September 2006: AREVA with COSACO, CEA with TOLBIAC-ICB, EDF with TOLBIAC-ICB, FZK with WECHSL, GRS with MEDICIS and WEX, UPM (Spain) with LELCOR, VTT with CORCON.

Results of all participants have been sent to all (December 2006). The experimental results are now open and comparison of the experimental results with calculations are in progress (January 2007)

Corium coolability

Post test calculations of the VWU1 experiment at CEA Cadarache have been conducted, as well as calculations of some debris coolability experiments.

A workshop has been held in Karlsruhe to discuss simplified spreading models that could be introduced in ASTEC.

CONTAINMENT (*Leo MEYER*)

WP 12-1, Hydrogen Combustion, in JPA/TPA-3 is concentrating on two activities, hydrogen recombiner experiments and modelling and a hydrogen combustion code benchmark to evaluate the capabilities and weaknesses of the codes used within SARNET for modelling. Experimental activities on recombiners continued as planned as well as recombiner model development. For benchmark it was decided to use experimental data from the ENACCEF facility. These experiments are kind of unique as they allow investigating hydrogen combustion with concentration gradients involved. Up to now a detailed description of the selected ENACCEF experiment has been finalized and sent to the interested partners. In the next 6 months the benchmark simulations have to be performed.

Within the WP12-2 CAM (Containment Atmosphere Mixing), a workshop was held on November 6 and 7 2006 in Pisa (Italy). The meeting, which was organized by the University of Pisa, was devoted to the following current activities within WP12-2: the spray benchmark, the PAR (Passive Autocatalytic Recombiners)-atmosphere interaction benchmark, and the condensation benchmark. The spray benchmark is being coordinated by IRSN (Saclay, France). So far, the results of simulations of tests TOSQAN 101 as well as MISTRA MASP1 and MASP2 have been submitted and compared by the coordinators. It has been agreed that, before the next meeting, revised simulation results of these tests may be submitted along with the simulation results of tests TOSQAN 113 and MISTRA MARC2b. Both lumped-parameter and CFD codes are being used for calculations. The PAR-atmosphere interaction benchmark is being coordinated by CEA (Saclay, France). At the meeting, the first phase of the benchmark was concluded with the final comparison and analysis of results. Various possibilities for the next phase were also discussed. The condensation benchmark is being coordinated by the University of Pisa. The meeting was used to kick-off the benchmark with the presentation of the specification. In the future, this benchmark should be complemented by experimental results. The next meeting of the WP12-2 CAM will be held in Chatou, France, May 24 - 25, 2007. Spray benchmark, condensation benchmark, and kick-off of next phase of PAR-atmosphere interaction benchmark will again be the main topics.

SOURCE TERM (*Tim HASTE*)

Following discussion at the last CEG-SAM meeting, a revised ISTC VERONIKA proposal that took into account previous SARNET input was reviewed again at their request and detailed recommendations were provided, in particular regarding the proposed test matrices, to the CEG-SAM secretariat in October.

Meetings of Technical Circles have been held as follows:

- WP14-1 on ruthenium release and transport under oxidising conditions (RU) on 17 October in Aix-en-Provence;
- WP14-2 on PWR control rod matters (SIC) on 16 September (restricted) and on 16 October in Aix-en-Provence;

- WP15 on steam generator tube rupture (SGTR), aerosol retention in cracks (CRACK) and physical resuspension (RSPN) on 18 September in Madrid, followed by a second RSPN meeting at PSI Villigen on 12 December; and
- WP16 on iodine interaction with passive autocatalytic recombiners (IPAR) and on interpretation of the ThAI-Iod9 test (ThAI) in Aix-en-Provence on 19 October.

Final minutes of the September meetings are available on ACT while draft minutes of most of the others have been circulated. The October meetings were held in conjunction with the Autumn 2006 meetings of Phebus FP and ISTP. Concerning the latter, meetings of the Phebus Containment Chemistry and ISTP Chemistry meetings were held as usual under the aegis of SARNET, and draft minutes have been prepared.

Experimental data and reports on the ThAI-Iod9 integral test on iodine behaviour in the containment, and on the STORM series on physical resuspension have been kindly supplied by GRS and JRC Ispra at SARNET request. These have been distributed to the relevant technical circles. A translation into English of the ThAI report has been arranged.

The attachment of a Slovakian MSc student from the Comenius University to work on theoretical evaluation of the kinetics of iodine reactions in the circuit (WP14-2) for one month at IRSN Cadarache has been successfully completed, with prospects of a further visit next year.

A draft programme for ERMSAR2007 has been proposed, with two invited presentations, an overview paper, and detailed presentations on ruthenium behaviour, iodine chemistry in the circuit, revaporisation and containment chemistry in Phebus FPT2. Detailed preparations have been made for the JPA3 review meeting at GRS Garching on 1-2 February 2007.

EXCELLENCE SPREADING

Education and Training: Since September, the main activity consisted in preparing the next training course, which is now practically ready and which will be held in Cadarache, France, March 12 to 16th, 2007. Other courses, are foreseen later on, possibly coupled with CSNI.

Book: A meeting, was held on September 15th in Aix-en-Provence, France, to develop the content of the various Sections and Chapters of the Book, entitled "LWR Severe Accident Safety". It allowed to decide the content, to dispatch the work between the various specialists who will write the different chapters and to mount an ambitious schedule which should lead to a first draft in May 2007, with the objective of publishing the book in March 2008.

Mobility: During these last months, the main point to be noted is that several mobilities involving both researchers and students were approved. Some of them have been already performed, other ones are ongoing or will be performed in the forthcoming months. For SARNET year 3 (from April 2006 to March 2007), 12 delegations will have been performed thanks to the SARNET mobility programme.

FUTURE EVENTS (events relevant to specific technical domains are not reported)

SARNET Annual review Meeting: January 29th to February 2nd, 2007, Garching (Germany)

Management Team meeting N°7: March 1st, 2007, Karlsruhe (Germany)

Governing Board meeting N°4: March 23rd, 2007, Budapest (Hungary)

ERMSAR 2007, June 12-14, 2007, Karlsruhe (Germany).

Advisory Committee Meeting N°3: October 12th, 2007, Paris (France)