

SARNET NEWS N°7

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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 now available on the SARNET WEB sites. It will be **hosted by FzK in Karlsruhe**. Due to different constraints, finally it will be held from **June 12 to June 14, 2007**. A provisional programme (to be discussed during the next management team meeting) and preliminary practical information are also available on the SARNET WEB sites.

The annual review of the SARNET NoE by the European Commission was performed on June 27th, 2006. It was a successful review, formally rating SARNET as "acceptable", with the following comment from the reviewers: "The project has achieved most of its objectives and technical goals for the period under review with relatively minor deviations. It therefore deserves the rating "acceptable" in the scale below although this word does not truly reflect its quality, which is good".

A meeting to discuss the SARNET Follow-up after the current European contract (i.e. from April 2008) was held on July 12th, 2006, at Clamart (IRSN headquarters). Many points were discussed and we can say that we are merging to a common view. Some actions are ongoing and a further meeting is scheduled on November 6th in Munich.

ASTEC (*Jean-Pierre VANDORSSELAERE*)

The 2nd ASTEC Users' Club, hosted by IRSN, took place in Aix-en-Provence from 19 to 22 June. The feedback of the 40 users from 26 partners who attended the meeting was very positive and discussions were very fruitful between users and developers. IRSN presented the main features of the next version ASTEC V1.3 to be released in October 2006. Most validation results were satisfactory. For benchmarks on plant applications, the **largely improved robustness and rapidity of the code** allowed to multiply complete sequence calculations involving most or all modules. This of course underlined discrepancies on some results that are being analysed (sometimes only through modifications of the input decks).

The release of the new version of the MARCUS tool for exchanges between users and developers has been postponed to September 2006.

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

A general partners meeting hosted by CEA took place in Aix en Provence on June 27th and 28th 2006. A two days meeting has been estimated not enough to review in details the status of the different tasks so that the next meeting duration has been fixed to three days (planned on January 23rd to 25th 2007 in PSI).

Most important progress concern:

- The preliminary results of survey on practices and guidelines which were provided and discussed,
- The principles of methods harmonization for hydrogen distribution and combustion, immediate consequences of vessel breach and associated uncertainties; the content of corresponding deliverables has been defined,
- The comparison of main probabilistic software now achieved (deliverable provided),
- The description of partners' methods to assess corium and concrete interaction,
- The first results of several partners concerning the benchmark exercise to compare dynamic reliability methods with classical ones,
- The identification and first description of software for uncertainties and sensitivities analysis in support to level 2 PSA,
- Development of SDTPD method and associated software and platform.

Besides, interesting discussions were organized about PSA2 partners opinion on SARNET follow-up and on the conclusions of the post FISA workshop on level 2 PSA methods harmonization and the associated perspectives for the PSA2 activities.

A new partner ISaR (Institute for Safety and Reliability – Germany) is expected to officially join the PSA2 group and technical exchanges have already started with this new partner.

CORIUM (*Jean-Michel BONNET*)

Early phase of core degradation work package: WP9

The SARNET Benchmark specification report on the QUENCH-11 experiment has been prepared jointly by INRNE and FZK during a 2 month stay of Ms. A. Stefanova at FZK. First results of the benchmark will be presented at the 12th QUENCH Workshop in October.

Preparations of the QUENCH-12 test with VVER bundle are in the final state. FZK, KI and especially PSI are actively involved in the planning for the experiment.

A joint PSI/FZK paper on pre-test calculational support for QUENCH tests 10, 11 and 12 has been accepted for the Nuclear Energy in New Europe 2006 meeting, Portoroz, Slovenia, on 18-21 September.

RUB-LEE has performed successfully calculations on QUENCH experiments -07 and -08 using ATHLET-CD 2.0A/1.1L as well as first calculations of PHEBUS FPT-3.

The Parameter test including top reflooding has been successfully performed on April 15th 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 is under progress with the MAAP code at EDF. Moreover, EDF has implemented air oxidation laws for claddings in the MAAP code. These laws are being tested against the Quench 10 experimental results.

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.

Late phase core degradation and vessel behaviour: WP10

The experiment LIVE-L1 was dedicated to investigate the core melt behaviour in the lower plenum of the reactor pressure vessel and the influence of the cooling of the vessel outer surface with water in the conditions that may occur during core meltdown accident in a VVER-1000 plant. The test, proposed by TUS (Sofia, Bulgaria), was successfully conducted at the FZK on 22 June 2006. All measurement, process, and recording systems worked well. It was the first of two experiments to be performed in the frame of the EC supported LACOMERA programme. The facility is now being dismantled for the post-test examinations, and the recorded data are being processed prior to further study. More details on this test are available on the ACT WEB site, at the WP10 page.

Simulation of first commissioning LIVE tests is on going at CEA with ASTEC, history of this water transient test is quite well reproduced. The work will be continued when LIVE-L1 results are available.

In the field of corium pool behaviour, RUB-LEE is working on fission product release from molten pools, analysis and models improvement.

Ex-vessel corium recovery: WP11

Debris coolability

The expected project for continuation of the IKE DEBRIS experiments has now been finally approved. Support and budget is agreed from October 2006 to September 2009. Thus, the new work can now be started. It includes:

- experiments on friction laws under boil-off conditions as well as dryout heat flux measurements with polydisperse steel spheres and especially non-spherical particles (top and bottom inflow of water),

- experiments with quenching of hot debris, polydisperse, non-spherical particles, top and bottom flooding,
- 2D configurations under boil-off and quenching.

In order to organize closer cooperation with KTH (Sweden) and VTT (Finland) about the WP 11.1 subjects, IKE are organizing to transfer its WABE code to these institutions. It is envisaged that colleagues from KTH and VTT visit IKE in August to get some introduction and to start the direct cooperation. VTT intends to use WABE for calculations on their STYX experiments as well as on reactor scenarios (especially ex-vessel debris in deep water pools). Likewise, KTH intends to calculate on POMEKO and COMEKO experiments. DEFOR experiments at KTH are also under consideration. Comparisons with own modelling approaches of KTH and VTT will be performed and exchange of results and proposals for model and code improvements is foreseen.

- Calculations on debris formation in the DEFOR experiments at KTH have been started at IKE.
- Comparisons of different WABE versions (especially separate versions and that included in ATHLET-CD) are being performed at IKE to reach a largely unified and as far as possible simplified version with potential for general applicability. Calculations presently concentrate on reactor scenarios with quenching of hot particulate debris in the lower head of the RPV. Since similar calculations have been performed by IRSN with ASTEC and ICARE/CATHARE, this work will also yield an improved basis for detailed comparisons foreseen with IRSN.

Corium concrete interaction

In the field of MCCI, the benchmark exercise coordinated by CEA is ongoing. The first candidate for the benchmark is the COMET-L2 test that has been performed in LACOMERA platform at FZK for homogeneous pool configuration. Experimental data have been processed and qualified. They were sent to collaborators (ARCS, AREVA, CEA, FzK, GRS, IRSN, UJV, UPM, VTT) in April. Calculations are under progress and the first results have been sent by seven partners to CEA at the mid of July for analyse and comparison.

Corium coolability

New WABE-COMET calculations on the VULCANO VW-U1 experiment have been started to check effects of time delay between the opening of water inlets which were considered to be at least partially responsible for differences between the calculations and the experimental results. The recently obtained CEA report on test section disassembly may contain further information useful for these checks. Further feedback with CEA is envisaged in a more progressed state of the attempts.

As a further support for the modelling and its checking, calculations on quenching experiments of given particulate debris (earlier experiments of Tutu et al at BNL, 1984 as well as DEBRIS experiments at IKE) are being continued. These also serve for the modelling related to WP 11.1 (debris coolability).

CONTAINMENT (*Leo MEYER*)

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

The task leader for WP12-2 (CAM) Henri Paillere (CEA) steps down and will be replaced by Ivo Kljenak of JSI Slovenia. The activities launched during the first and second JPAs will continue, with the publication of a state-of-the-art report on the modelling of steam condensation in CFD codes, and the launch of a benchmark for model validation. This task is coordinated by the University of Pisa; the second activity is the benchmark on the interaction between Passive Autocatalytic Recombiners and containment atmosphere. This activity, coordinated by CEA, has highlighted the need for new experiments which can describe the complex interaction between the hot plume of combustion products exiting the recombiners' outlets and the surrounding atmosphere, with turbulent mixing, entrainment and stratification phenomena. The third activity, coordinated by IRSN, deals with the study of the interaction of the atmosphere of the containment with sprays: depressurisation and stratification break-up are the two main phenomena that are studied, and a benchmark based on experimental data

provided by IRSN (TOSQAN spray tests) and CEA (MISTRA spray tests) has been defined, for both Lumped Parameter and CFD codes.

An FCI Technical Meeting was held at IRSN, Fontenay-aux-Roses in April 2006. The main objective of the meeting was to discuss the conditions and pre-calculations of the KROTOS-PLINIUS test in preparation at CEA in the frame of the PLINIUS contract with the Commission, and further actions. Several analytical investigations are being performed by the partners.

After holding the second workshop on DCH modelling the first benchmark exercise on the LACOMERA test L1 has been concluded. Three reports on the calculations with the lumped parameter codes MAAP, ASTEC and CONTAIN, and one review report have been written.

SOURCE TERM (*Tim HASTE*)

In the Source Term domain, one may mention:

- The paper "SARNET: Integrating Severe Accident Safety Research in Europe: Safety Issues in the Source Term area", was presented at the ICAPP-06 meeting, Reno, 4th-8th June 2006.
- The ISTC VERONIKA proposal was reviewed at the request of CEG-SAM, and an integrated set of comments has been provided.
- The attachment of an INR staff member to IRSN Cadarache under the Mobility programme, to work on air ingress plant calculations with ICARE/CATHARE (WP14-1), has been successfully concluded. An application for 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 approved by SARNET management.
- Meetings of the Phebus and ISTP Containment Chemistry Interpretation Circles were held under the aegis of SARNET in April 2006, and final minutes have been posted on ACT.
- Technical circle meetings of WP15 REVAP (revaporisation), WP16 ROX (radiolytic oxidation of iodine), and WP16 RUTH (ruthenium behaviour in the containment) were held in Aix-en-Provence on 17 July, while a meeting of the technical circle WP14-2 HITEMP (iodine behaviour in the circuit) was held at Cadarache the following day. Draft minutes are posted on ACT.

A set of WP15 technical circle meetings on SGTR (steam generator tube rupture), CRACK (aerosol retention in cracks) and RSPN (resuspension) is planned for the week of 18-22 September in Madrid, while a WP14-2 meeting on PWR control rod matters is planned for September at Cadarache. Meetings of the ThAI (interpretation) and IPAR (effect of recombiners on fission product heating) circles are planned for the Phebus week in October, along with the customary Phebus and ISTP chemistry meetings. Jointly, a WP14-1 OXIDEN meeting (FP release under oxidizing conditions) will be organized in the same week.

EXCELLENCE SPREADING

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.

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

Management Team meeting N°6: September 14th, 2006, Aix-en-Provence (France)

Advisory Committee Meeting N°2: October 13th, 2006, Chatou (France)

SARNET post-FP6 meeting: November 6th, 2006, Munich (Germany)

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

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