NUCLEAR ENERGY AGENCY
COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS

Working Group on the Analysis and Management of Accidents

SUMMARY RECORD OF THE ELEVENTH PLENARY MEETING

Held from 23rd to 26th September 2008, at the OECD Headquarters, Paris, France

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The 11th Plenary Meeting of the Working Group on the Analysis and Management of Accidents
September 23-26, 2008
OECD Headquarters, 2, rue André Pascal, 75016 Paris, France

Summary

The 11th WGAMA plenary meeting reviewed the status of ongoing work, in particular in the areas of uncertainty evaluation (BEMUSE), CFD application, knowledge transfer, and severe accident analysis. The report on “Ability of Current Advanced Codes to predict Core Degradation, Melt Progression and Reflooding – benchmark Exercise on an Alternative TMI-2 Accident Transient” was endorsed by WGAMA to be submitted to PRG for approval. The same decision was taken for the State-of-art report on nuclear aerosols.

Ongoing activities in the frame of Projects relevant to WGAMA activities were also presented and discussed. Half a day was spent to present and to discuss the status of the Sump Filter Clogging Issue.

A major part of the meeting was dedicated to the discussion on possible future activities. Decisions were taken for initiating near-term activities: four CAPS were agreed to be submitted to PRG for approval during its October 2008 meeting. They respectively concern: CFD4NRS 3rd Workshop, CFD Benchmark, ATLAS ISP and In-Vessel Coolability Workshop. Longer-term activities will be further discussed during the next WGAMA Plenary Meeting which will take place on September 29-October 02, 2009.

In the following sections, the results from the discussions on the individual agenda items will be summarized.

1. Opening

Opening: The WGAMA Chairman, Ivan Tóth, opened the meeting and gave the floor to Mr. Yoshimura, the new NEA Deputy Director for Safety and Regulation. Mr. Yoshimura introduced himself and underlined the role and the importance of WGAMA activities. In particular he emphasized WGAMA cooperation with other CSNI Working Groups and expressed his interest to attend the WGAMA discussion on new activities and proposals. The WGAMA Chairman welcomed the new delegates and the new members of the Secretariat who were invited to introduce themselves.

2. Agenda

The Agenda was adopted, although the order of some items was changed to fit specific requests.

3. Summary record of 10th meeting

The summary record of the 10th plenary meeting of September 2007 [NEA/SEN/SIN/AMA(2007)10] was approved.

4. Report on the last two CSNI meetings

The WGAMA Chairman reported on the last two CSNI meetings. He focused on the achievements of the WGAMA, the activities approved by the CSNI and the cooperation with other CNRA or CSNI Working Groups. In particular, he underlined the CSNI satisfaction regarding the successful completion of the
two seminars dedicated to knowledge transfer (EU-SARNET/OECD Joint Training Course on Nuclear Reactor Severe Accident Analysis and THICKET-2008).

In the December 2007 and June 2008 meetings, CSNI approved the following reports:

- Assessment of CFD Codes for Nuclear Reactor Safety Applications [NEA/CSNI/R(2007)13],

CAPS were approved for the following activities:

- CAPS GAMA (2007)1 for establishing web-based information on the application of CFD to Nuclear Reactor Safety,
- CAPS GAMA (2007)2 for investigating Core Exit Temperature (CET) effectiveness in Accident Management,
- CAPS of the Workshop on Implementation of Severe Accident Management (SAM) Measures which will be a joint activity with WGRISK.

5. **Integrated plan: Update**

The Secretariat provided short information on the update of the WGAMA Integrated Plan. It is proposed to update the Integrated Plan, on an annual periodicity basis, after the WGAMA Plenary Meeting discussion and the decisions taken during the CSNI December Meeting.

6. **Overall status of WGAMA Work**

The Secretariat provided an update of the status of WGAMA activities. It addressed the current WGAMA activities and the status of their achievement as well as the requests for WGAMA endorsement before submission to PRG/CSNI.

7. **BEMUSE programme**

A. **Phase V activities**

The Phases IV and V Coordinator (F. Reventos, UPC) provided an update about these two BEMUSE phases. As for BEMUSE Phase IV which the report was approved by the CSNI in June 2008, he recalled the main conclusions, i.e.:

- All participants managed to simulate the scenario and to predict the main parameters with credible consistency,
- Maximum values of calculated Peak Cladding Temperature (PCT) are quite close to each other,
- PCT time trends and timing of complete core rewet still show some disagreements.

As for Phase V, F. Reventos presented the results obtained so far and discussed during the Task meeting held at the NEA Headquarters on September 1-3, 2008. The results of 14 participants, presented in terms of mean cladding temperature, lower band and upper band, were judged acceptable. Also the feedback from Phase III has been very useful in calculation specifications and in participant contributions. However, some participants to Phase IV did not complete their contributions as requested following the Task Group Meeting on September 1-3, 2008. Moreover, the draft report did not go through independent review as it
was initially planned. Consequently, WGAMA members decided to postpone to April 2009 the submission of the report to PRG for approval. The independent review will be made by Andrea Bucalossi from the EC/JRC.

B. Phase VI activities

F. Reventos presented the status and outlook for continuation / completion of the BEMUSE Phase VI for H. Glaeser, Coordinator of this Task, who could not attend the WGAMA Plenary meeting. The related outlook refers to each of the precedent five phases and its outcomes. Due to the postponement of Phase V report submission to PRG/CSNI, BEMUSE Phase VI report submission to PRG/CSNI was consequently postponed to the autumn 2009.

It was agreed that US NRC which did not participate to BEMUSE activities would provide an independent review of Phase VI report.

8. Results of the Compilation and Analysis of the Questionnaire on the Use of Best-estimate Methodologies

F. D’Auria gave an overview of the answers received so far to the Questionnaire on the Use of Best-estimate Methodologies. From the long discussion which followed, three main ideas emerged:

- the need for a coordination of WGAMA activities in the area of BEPU with the OECD/NEA/NSC UAM activity in order to ensure synergy as much as possible;
- the need of a “standard” or at least harmonization among Best-estimate Methodologies;
- for the probabilistic methods, a benchmark of methods to determine the uncertainties of the key input parameters in order to justify the assumptions made on their uncertainty in the propagation step.

However, it was agreed to postpone the decision for future activities after the issuance of BEMUSE Phase VI report.

9. CFD Code Guidelines, Assessment and Extension to 2-phase Safety problems:

A. Experiments and CFD Code Application for Nuclear Reactor Safety Workshop

The report of D. Bestion, General Chairman of the Workshop, covered the programme, the participation, the panel session and the conclusions of the XCFD4NRS Workshop held in Grenoble on September 10-12, 2008. The programme included 5 invited lectures, 3 keynote lectures and 9 technical sessions, followed by a panel session. 2/3 of the papers were on 2-phase and 1/3 on single phase. About 1/3 of the papers were related to experiments and instrumentation techniques; they were mixed with papers on CFD application in order to promote exchanges. 146 experts were registered (97 non-French, 49 French) and came from Europe, China, India, Japan, Korea, South-Africa and United States.

The main conclusions of the Workshop were the following:

- More application of Best Practice Guidelines (BPG),
- As expected, CPU time limitations may prevent from full application of BPG in reactor application,
A full transparency on code features is required for application to safety, which is not provided by commercial CFD codes,

Validation of CFD for application to 2-phase issues is in progress but still requires additional data,

BPG in 2-phase exist for control of numerical errors but not yet for the selection of the best physical option,

There is progress in the multi-scale approach of some issues,

Uncertainty evaluation of CFD prediction is necessary; hence, development of methodologies should be promoted.

USNRC is interested to host the next CFD Workshop which will take place in 2010. The related CAPS should be prepared by J. Mahaffy and S. Bajorek, distributed to WGAMA for final endorsement and submitted to PRG for approval during its October 2008 meeting.

The WGAMA Chairman who attended the Workshop underlined its quality and thanked D. Bestion and the Organizing Committee for their efforts. The Secretariat was requested to distribute the Workshop CD-ROM to all WGAMA members.

B. Writing Group 3 (extension to 2-phase)

D. Bestion reported on the status of the CFD extension to 2-phase activity. Due to his heavy involvement in the XCFD4NRS Workshop, some parts of the report are still missing. However, a draft report is expected to be ready by end of December 2008. It will be distributed in parallel to M. Réocreux for independent review and to WGAMA for endorsement before submission to PRG in April 2009.

C. Special CFD Group

B. Smith reported on the Special CFD Group, in particular its mandate and the status of its activities. This group which is composed of the 3 CFD Writing Groups Chairmen, plus the Secretariat and the NEA Webmaster, met in May 2008 and drafted the structure of the Web-based Information Centre which was set-up using Wiki software. The WG2 document “Assessment of Computational Fluid Dynamics (CFD) for Nuclear Reactor Safety Problems” was loaded. At the end of his presentation, B. Smith made an online demonstration. Some topics (e.g. illustrative pictures or videos) are still to be loaded. In this respect, the Secretariat was requested to coordinate with the NEA Webmaster to give B. Smith access to navigation bars and to provide help for the implementation of the pictures and videos.

10. TH knowledge transfer seminar THICKET-2008

A. Del Nevo (Pisa University) gave an overview of the THICKET-2008, addressing the participation, the programme and the main outcome. THICKET-2008 was jointly organized by Pisa University and the NEA Secretariat on May 5-9, 2008 in Pisa. It was mainly based on THICKET-2004 content but with some new topics (e.g. CFD, PTS). It included 10 sessions with 30 lectures for 36 participants from 28 institutions and 14 countries. The course material was distributed to the participants as book proceedings and also as a CD-ROM. The participants assessed THICKET-2008 as an interesting seminar to be organized regularly.
The WGAMA discussed the major remarks made by the participants in their assessment of the THICKET-Authority (TAEK) to host it. The Secretariat was requested to coordinate with TAEK, to formulate a CAPS and, as soon as possible, to circulate it to WGAMA for endorsement and to PRG for approval. The EC and the IAEA representatives expressed their organizations willingness to co-organize such activity and to help for covering the cost of participants from eligible countries. The Secretariat confirmed that the THICKET-2008 CD-ROM can be made available to WGAMA members upon request.

11. Severe Accident knowledge transfer seminar 2008 in collaboration with SARNET

The update was provided by S. Güntay as member of the Organizing Committee. The EU-SARNET/OECD Joint Training Course on “Nuclear Reactor Severe Accident Analysis: Applications and Management Guidelines” was organized by CEA, AEKI, BME and VEIKI in Budapest on April 7-11, 2008. 50 participants from 19 countries (Australia, Canada, several EU countries, Japan, Russia, Switzerland, Ukraine and USA) took profit from the 22 sessions which covered the most important aspects of severe accidents for different types of reactors (PWR, VVER, BWR, CANDU and new reactors). The course material was distributed as hard copies and also as electronic files.

The participants assessed the course as very interesting and recommended that similar course should be organized regularly. During WGAMA discussion, it was suggested that the course content should maintain a balance between fundamentals and applications in order to consider possible differences in backgrounds, experiences and expectations of participants.

Like for THICKET, the EC and the IAEA representatives expressed their organizations willingness to co-organize such activity and to help for covering the cost of participants from eligible countries.

12. Core Exit Temperature (CET) Activity

I. Tóth, Chair of the Core Exit Temperature (CET) effectiveness Task Group, provided the status of this Task which started early 2008 with representatives from AREVA-France, AREVA-Germany, Belgium, Hungary, Italy, Japan, Korea, Slovenia, Spain and Switzerland. He reported on the outcomes of the two meetings held respectively on April 24-25 and September 22, 2008. During the first meeting, the participants exchanged information on different countries status in CET use for Accident Management (AM); they also discussed available experimental data (PKL, ROSA, LOFT) for confirmation of CET use in AM, including the effect of CET thermocouple location. At the end of this first meeting, a questionnaire was drafted and distributed to WGAMA members. During the second meeting, the participants discussed the synthesis of the answers to the questionnaire received from Belgium, Finland, France, Germany, Japan, Korea, Netherlands, Spain, Switzerland and USA. They also exchanged and discussed experimental insights to the CET effectiveness issue and defined the content and the structure of the Draft Report. A tentative schedule of the remaining activity up to the reporting to the CSNI in December 2009 was also defined. The whole activity is so far proceeding according to schedule.

During the discussion, W.P. Baek mentioned that upon the request of WGAMA, KAERI can measure CET and PCT with appropriate thermocouples and provide the members with the corresponding data.

13. Analysis of Accident Progression

F. Fichot, Coordinator of the activity on analysis of accident progression, presented the main results of the related report entitled “Ability of Current Advanced Codes to predict Core Degradation, Melt Progression and Reflooding – Benchmark Exercise on an Alternative TMI-2 Accident Transient”. All the comments made by WGAMA members and by the independent reviewer (J. Martinez) were considered.
The following main conclusions could be drawn:

- A reference severe accident scenario, initiated by a SB-LOCA, based on a TMI-2 plant model, was defined with prescribed boundary conditions in order to minimize the influence of uncertainty of these conditions;

- Good agreement between the calculations was observed for the thermal-hydraulic phase (up to primary system pumps trip);

- For the degradation phase, up to the reflooding of the core, the calculated results show a rather good agreement between all the participants for global parameters such as total hydrogen production and total mass of molten material. This indicates the progress in system codes since the last TMI-2 benchmark which was performed 20 years ago;

- However, though all codes show agreement, some results may be questionable as they are apparently in contradiction with experimental observations (e.g. LOFT and QUENCH). Moreover, agreement is lacking for the calculated efficiency of quenching. Therefore, more modelling and assessment should be carried out before codes can be considered reliable enough to calculate the reflooding phase. More generally, sensitivity studies performed by participants to the benchmark have shown that results were sensitive to some key empirical models (e.g. cladding failure);

- Some weaknesses of current codes were identified to be reason of scattered results. These are: oxidation of molten mixtures and their relocation, UO2 melting and its interaction with molten corium, core coolability and the behaviour of hot corium when the vessel is entirely reflooded.

The group noted that there are no standardized or harmonized approaches of best-estimate methods for severe accidents, in particular for uncertainty evaluation which is quite challenging issue. A kind of brainstorming activity on the definition of “best-estimate methodology” and “uncertainty analysis” in the area of severe accident should start in future.

After discussion, the report was endorsed by WGAMA and will be submitted to PRG for approval during its next October 2008 meeting.


H.J. Allelein, Coordinator of the Writing Group of the State-of-the-art report on nuclear aerosols provided an oral update on this report and confirmed its completion; he emphasized the important work made to revise and to structure both the chapter 8 and the Executive Summary. B. Clément, independent reviewer of the report, recalled the main conclusions of his independent review and went through his comments which have been implemented in the last version.

After discussion, the WGAMA endorsed the report which will be submitted to the PRG for approval during its October 2008 meeting.

15. Containment Code (phenomena-based) Validation Matrix

H.J. Allelein, Coordinator of the Containment Computer Validation Matrix (CCVM) activity recalled the status of this task which did not progress for years. He pointed out that 40% of the related data is from Germany which changed its policy in disclosing the data. S. Güntay, Vice-Chair, proposed to pursue the activity and to come-up with a product with the available information. I. Tóth, WGAMA Chairman,
recalled what was decided during the last WGAMA Plenary Meeting (i.e. it was accepted by the WGAMA members that establishing a databank where all the test data can be retrieved did not appear to be opportune). The present status as highlighted by H.J Allelein was the following:

- Minutes of the related meetings are available and can be used;
- Chapters dealing with the phenomena are also available;
- However, harmonization of the presentations of the related facilities according the template which was distributed is still missing.

After a discussion whether the WGAMA has to pursue the activity, it was concluded to complete it by producing a report which describes the tests available. For that end, it was proposed to establish a small group including IRSN, Canada and Germany. The test owner countries were asked if they can back-up the activity completion which was confirmed. The Secretariat was requested to take contacts and to coordinate with H.J. Allelein and with the Chairs.

16. Concise status reports on Projects and CSNI Task Groups

Short presentations on OECD Projects and CSNI Task Groups activities relevant to WGAMA were given, summarising the status and results obtained. In particular, a detailed presentation on PRISME Project status and outcomes was given by IRSN.

A. PKL

K. Umminger (AREVA NP, Germany), Project Manager provided a presentation on the PKL project. He recalled that the main objective is to address Thermal-hydraulic safety issues for current PWR and new PWR design concepts through experiments in PKL facility. The present project PKL2 is scheduled from April 2008 to September 2011. It involves 15 participating countries for 8 integral experiments in the PKL facility. The topics of investigation will concern: heat transfer mechanisms in the SGs in presence of Nitrogen, cooldown procedures with SGs isolated and emptied on the secondary side, fast cooldown transients such as Main Steam Line Break, accident situations under reflux condenser conditions for new PWR design concepts, and Boron precipitation processes after LB-LOCA. The subjects of 2 tests are still open to be defined during the programme period.

B. Behaviour of Iodine (BIP)

The status of the Behaviour of Iodine Project (BIP) was presented by Glenn A. Glowa (AECL). The project which started about one year ago is expected to run until 2010. The aim is to analyse RTF tests performed in the past, and to perform new tests on I$_2$ adsorption on surfaces and on organic iodine production on surfaces. After approximately one year of running this Project, 2 programme review groups meetings were held, 2 RTF data reports were provided, 10 organic iodide tests and 8 gas phase adsorption tests were completed.

C. SERENA-2

The status of the SERENA-phase 2 project was presented by J. Gauvain (NEA Secretariat). This phase which started in October 2007 is planned for 4 years and involves 11 NEA member countries. It aims at performing confirmatory research required to reduce uncertainties on major FCI phenomena to acceptable level for risk assessment. 12 tests are scheduled to be carried out in the TROI facility (Korea) and the KROTOS facility (France); analytical work will accompany these tests.
D. ThAI

An update of the ThAI Project was provided by H.J. Allelein. The test programme has started in April 2007 and will be completed by December 2009. It includes more than 30 tests dedicated to Hydrogen-Helium Material Scaling tests, Hydrogen Deflagration tests, Hydrogen Recombiner tests, and Iodine and Aerosol tests. The test results should contribute to a better understanding of the phenomena, and provide good material for benchmarking of severe accident analysis methods (e.g. Hydrogen deflagration, see Agenda item 20).

E. SETH-2

The status of the SETH-2 project, in which separate effect tests are to be performed to assess LWR containment performance phenomena during accidents, was presented by J. Gauvain (NEA Secretariat). This project which started in March 2007, builds on the results of the SETH-1 test programme, performed using the PANDA test facility at PSI/Switzerland. By December 2010, SETH-2 tests should be complemented by large scale tests in the PANDA and MISTRAS (CEA) test facility aiming at generating a database for steam/gas distribution for multi-compartmented confinements. Both CEA, PSI and some other participants provided pre-test calculations. Post test calculations will start by the end of 2008. The testing, relevant not only to existing but also to generation III and IV type reactors, should again provide good material for benchmarking and validation of safety analysis methods. In this respect, SETH-2 Project will discuss later the possibility of offering selected results to WGAMA in view of an open calculation exercise.

F. PAKS

The status of the PAKS project was presented by the Secretariat. The objectives and outcomes of this NEA and IAEA joint project were recalled and could be found in http://www.nea.fr/html/nsd/docs/2008/csni-r2008-2.pdf.

G. PRISME

As WGAMA expressed its interest to receive regular feedback on the progress in PRISME Project, a detailed presentation was provided by M. Faury (IRSN).

This project which involves 17 organizations from 12 member countries is scheduled from January 2006 to December 2010, with the following objectives:

- to study experimentally the heat and smoke propagation inside a facility composed of several rooms connected by doors and by a ventilation network; the resulting data can serve for code validation;
- to measure the mechanical and thermal stresses generated inside the fire room and the neighbouring rooms for a well characterized heat source;
- to study equipment behaviour (e.g. electrical cable failure and degradation) when submitted to thermal stresses generated by a fire.
The experiments are conducted in SATURNE and DIVA facilities of IRSN which is the Operating Agent. The experimental programme includes 3 phases:

- **Phase 0** (pre-project phase) dedicated to characterize the fire source in open atmosphere conditions and in a confined and ventilation configuration. This phase was completed in 2006 and the related reports were distributed in April 2006.

  Phase 1 deals with separate effect tests and includes PRISME Door (propagation through open doors and ventilation networks) and PRISME Leak (leaks and crossing ventilation duct). This phase is dedicated to study propagation mechanisms of heat and smoke in contained and ventilated multi-room configurations and to characterize thermal stresses on room walls, ventilation ducts and exposed equipment. PRISME Door has been completed and the related reports were distributed in July 2008. PRISME Leak is expected to be completed by the end of 2008.

- **Phase 2** is dedicated to integral tests in contained ventilated multi-room configurations. The related tests are scheduled for 2010.

## H. PSB-VVER

J. Gauvain (NEA Secretariat) provided an update on PSB-VVER Project involving Russia, Czech Republic, Finland, France, Germany, Italy and USA.

This Project which was initially scheduled from January 2003 to June 2006 had some delay due to the difficulties in preparing the Test 5 (LB-LOCA at 10 MW) while Tests 1 to 4 were conducted from May 2003 to May 2005. The Operating Agent (EREC) failed to perform the last test (Test 5) in May 2008. In June 2008, the status of this Project was reported to the CSNI; it was proposed to close the project as appropriate. A draft final report was issued on September 19th, 2008. It is expected to close the project before the end of 2008.

## I. TAREF

The Task on Advanced Reactor Experimental Facilities (TAREF) was presented by the Secretariat. After a recall of the backgrounds of this activity which was launched by the CSNI as a follow-up of the RRRC-2 Workshop, the TAREF terms of reference (objectives and scope) were highlighted. TAREF will focus on Gas Reactors (lead by USNRC) and Sodium Fast Reactors (lead by IRSN), considering that SFEAR had addressed Advanced Water Reactors. So far, China, Czech Republic, Finland, France, Germany, Hungary, Japan, Korea and USA have nominated experts to participate in TAREF. Canada expressed an interest to develop a similar task on Supercritical Water Reactors.

## J. SM2A

The CSNI Task on Safety Margins Assessment and Application was presented by the Secretariat. This Task which was set-up by the CSNI in December 2007 was initially aimed to appraise the SMAP methodology using US proposed new LOCA rulemaking as a test case. It involves organizations from 9 countries as well as IAEA which met 2 times: in January 2008 and June 2008. During the first meeting, the participants decided to apply the SMAP methodology to ZION NPP with a hypothetical Power Uprate (PU) of 10%. During the second meeting, results of the review of all assigned event trees selected from ZION PSA were presented. About 18 significant event sequences to be impacted by PU have been identified based on the agreed screening criteria. Also, the list of missing information was identified with assignments to fill the gaps. During the 3rd meeting planned in January 2009, it is expected to approve the
revised selection of event sequences and the list of parameters to be sampled, to harmonize modelling assumptions as appropriate and to define first draft outline of final report and the schedule to produce calculations.

Three experts from WGAMA are involved in SM2A activities. For WGAMA/SM2A cooperative actions, the Secretariat is requested to coordinate between WGAMA and SM2A Chairs in order to clearly define the support expected from WGAMA.

17. Concise status reports on PACTEL and SOARCA

A. PACTEL

The status of this (presently non-OECD) project was presented by I. Karppinen (VTT, Finland). The PACTEL test facility has been reconstructed/upgraded, in particular by adding vertical SGs, with support from the Finnish industry in order to provide a platform for testing AM (SBLOCA, PRISE, ATWS, Steam Line Break) procedures, especially for EPR. The characterisation testing (pressure losses, heat losses, natural circulation, loss of SG feedwater) started and might be completed by 2008, after which (summer 2009) first tests in PWR configuration may start in an international programme frame.

B. SOARCA

S. Bajorek (US NRC) provided an update on the State-of-the-Art Reactor Consequence Analyses (SOARCA) Project. The objectives of this project are to perform a state-of-the-art, realistic evaluation of severe accident progression, radiological releases and offsite consequences for important accident sequences and to replace previous (conservative) consequence analyses. A pilot study for one PWR and one BWR was completed. The preliminary findings show that, thanks to the 25 year knowledge progress, some measures have potential to prevent or significantly delay core damage.

18. Technical Discussion on Sump Filter Clogging Issues

During the CSNI meeting of December 2007, GRS communicated its intention to set-up a data base on the Sump Filter Clogging issue. While interest was expressed by several members, the CSNI recommended, as a first step, to present and to discuss the proposed activity during the 11th WGAMA Plenary meeting. Possible additional steps will be discussed thereafter.

The present technical discussion is a follow-up of this CSNI recommendation.

The Secretariat provided an introduction to the Sump Filter Clogging Issues, with a focus on the outcome of the Workshop organized in Albuquerque in February 2004. The WGAMA members were also informed about the upcoming Workshop which will be organized by the CNRA on December 4-5, 2008.

B.M. Pütter (GRS) made an overview on debris impact on Emergency Coolant Recirculation addressing the related findings and requirements in Germany, some international findings and topics and required investigations likely to enhance knowledge for safety demonstration. He also presented the knowledge base for “sump clogging” being developed by GRS and invited the WGAMA members to support the set-up of this knowledge base.

V. Borzov (IRSN) provided a similar presentation with a focus on the issues raised during the Quadripartite Working Group Meeting (France, Germany, Japan, USA) held on October 17-18, 2007, and on IRSN experimental programme performed on chemical effects. A list of topics which may require OECD/NEA action was proposed in connection with the Sump Filter Clogging issue.
From the discussion focusing on whether WGAMA can handle a work in this field, it was concluded that:

- The WGAMA Chairman and the Secretariat will report to the next WGAMA Plenary meeting about the December Workshop;
- It is necessary to wait for the outcome of the presentations to CNRA and CSNI, and then to formulate a proposal to the next WGAMA meeting. The proposal will be prepared by the USNRC.

19. Follow-up of the ROSA Project

H. Nakamura and S. Güntay made two presentations in support to the continuation of ROSA project with the main objective to investigate reflux cooling under DBA and severe accident transient conditions through a coupling between ROSA /LSTF (for integral system response) and ARTIST/RFLX. The member countries had the opportunity to express their interest to participate in this project during the dedicated expert meeting on September 26th, following WGAMA meeting. S. Bajorek who was not able to attend that expert meeting expressed USNRC interest in the continuation of ROSA but had to report to his Management; final decision depends upon the availability of funds.

20. WGAMA future activities

This Agenda item included the views of the Chairman and the Vice-Chairman on possible future activities in the area of Thermal-hydraulics and Severe Accidents, respectively. Several concrete proposals were made.

   A. Workshop on Implementation of Severe Accident Management Measures

The WGAMA Vice-Chairman, S. Güntay, provided a short presentation on the meeting of the Organizing Committee (OC) of the Workshop which was held on September 22, 2008 at the OECD Headquarters. The main objectives of the meeting were- to deepen the discussion on the main areas of the Workshop and to define the schedule for submitting abstracts, notification of acceptance, submission of full papers and presentations.

On the basis of the experience gained from the previous Workshop held in Switzerland in 2001, the OC could draft a series of topics to be structured under sessions which should be addressed during the Workshop.

Regarding the schedule, the OC could define a schedule with the associated deliverables. The date of the Workshop was not yet defined as it would be highly desirable to organize it after the Workshop on In-Vessel Coolability which outcomes may be an interesting input to the first one.

   B. Possible activities in Thermal-hydraulics

The WGAMA Chairman, I. Tóth, provided an overview of the Thermal-hydraulic issues for near future and for longer run and proposed his related questions and perspective. In particular, he recommended to define the next steps based on BEMUSE conclusions and questionnaire, to define what should be the focus of the next workshop on CFD and put the question on how to proceed regarding sump strainer clogging. In a longer run, he recommended to WGAMA members to think about advanced reactors. In his perspective, WGAMA work may complement TAREF actions in which PIRT might be a good starting point and to address some proposals made to CSNI following the RRRC-2 Workshop.
C. Possible activities in Severe Accidents

The WGAMA Vice-Chairman, S. Güntay, highlighted several activities in the area of Severe Accidents such as: In-Vessel coolability/retention and accident stabilization, Best-estimate guidelines for lumped parameter analysis of containment thermal-hydraulics, aerosol source term, mitigation, Level 2 uncertainties and ISP on hydrogen deflagration. He also considered mid-term activities (ISP, preparation of technical reports) coupled with completion of OECD or other international projects for which the discussion is postponed to the next WGAMA Plenary meeting.

D. CFD Benchmark:

The WGAMA endorsed the principle to launch within one year a CFD Benchmark based on a Vattenfall T-junction experiment. The corresponding CAPS which will be prepared by B. Smith has to be submitted to PRG for approval during its October 2008 meeting, after final endorsement by WGAMA members.

E. ATLAS ISP:

The proposal is based on DVI (Direct Vessel Injection) break scenario and the ISP will last 2 years. The related CAPS has to be submitted for PRG approval during its October 2008 meeting, after final endorsement by WGAMA members.

F. Advanced reactors:

Following the presentation made by S. Bajorek (USNRC), the group agreed to wait for the outcome of the next TAREF meeting (November 2008) and to propose a CAPS for a Knowledge Management Workshop on Advanced Reactors. This CAPS should be submitted to PRG for approval in April 2009.

G. In-Vessel Coolability Workshop:

The Workshop is proposed to take place early September 2009 in Cadarache; so to allow to report to the Workshop on Implementation of Severe Accident Management Measures. The organization will be ensured by IRSN, with PSI support. The related CAPS has to be submitted for PRG approval during its October 2008 meeting, after final endorsement by WGAMA members.

H. ISP on Hydrogen Deflagration:

It is proposed to launch an ISP on Hydrogen Deflagration using test results from the French small scale facility ENACCEF and the German ThAI facility. The ISP is expected to last 16 months once launched. The related CAPS has to be submitted for PRG approval during its April 2009 meeting, after endorsement by WGAMA members.

I. Best-estimate Guidelines for Lumped Parameters Analysis of Containment Thermal-hydraulics:

The Secretariat is requested to send out an e-mail to WGAMA members requesting nominations for a special group dedicated to this activity. The CAPS has to be prepared and circulated to WGAMA members for comments prior to the submission to the PRG for its April 2009 meeting.

J. Aerosol source term, mitigation, Level 2, uncertainties:

It is proposed to organize a Workshop focusing on aerosol source term, mitigation, Level 2 and uncertainties. The CAPS will be drafted by H.J. Allelein with support from S. Güntay and B. Clément. H.J. Allelein offered to host the Workshop; IRSN will check if it can take the lead. The related CAPS has
to be prepared and circulated to WGAMA members for comments prior to the submission to the PRG for its April 2009 meeting.

K. Follow-up of the TMI-2 Benchmark:

The report on “Ability of Current Advanced Codes to Predict Core Degradation, melt Progression and Reflooding – Benchmark Exercise on an Alternative TMI-2 Accident Transient” recommends to continue such benchmark exercises and to involve more users and more codes. It was proposed to use the report “reference scenario” to investigate the effects of SAM actions and estimate the confidence in using codes to predict the consequences of SAM actions. It was agreed that the interested organizations will coordinate and bring a proposal to the next WGAMA annual meeting.

L. General discussion

The outcome of the general discussion is summarized in the Table in Appendix 4, with the associated schedule for submission to the PRG/CSNI or for further discussion within the WGAMA. Since this Table has been circulated for comments after the 11th WGAMA Plenary meeting, its final version enclosed in the Appendix 4 may serve as a reference for all future WGAMA activities provided that these activities will be approved by PRG/CSNI after previously having been agreed upon by the WGAMA members.

21. National reports

There were no national reports.

22. EU and IAEA activities of interest to WGAMA

A. SARNET

An update of the SARNET (Severe Accident Research Network of Excellence) was provided by B. Clément (IRSN). He summarized SARNET achievement from April 2004 to September 2008. He informed about the follow-up in the frame of SARNET 2 which is in final negotiation with the European Commission. SARNET 2 which will involve 41 partners from Europe, Canada, Korea and United States is intended to focus on few targeted research needs; scientific research will cover six high level priority issues as defined in SARNET and will be organized in 4 work packages: corium and debris coolability, molten corium concrete interaction, containment and source term. Two major experimental programmes are foreseen: In-vessel degraded core coolability and/or ex-vessel corium coolability, and corium interaction with concrete. Cooperation with international programmes, in particular with OECD/NEA will be pursued.

B. IAEA

S. Lee provided a presentation on the ongoing IAEA activities relevant to WGAMA. He addressed IAEA Safety Standards and Guides, IAEA new publications and the recent or near future activities of the Agency (Review of accident management programme, Advanced safety assessment methods for nuclear reactors, Review of the safety of new reactor designs, Benchmarking exercise of severe accident modelling, Use of CFD for nuclear reactor safety, Use of safety margins and advanced assessment methods in plant modifications).
23. Meeting summary: action items and decisions

The actions and decisions from this meeting are summarised in the Highlights (Appendix 3), which are consistent with the Table of Appendix 4.

24. Other matters

There were no other matters for discussion.

25. Next meeting

The next WGAMA Plenary Meeting will be held at the OECD Headquarters, Paris, from September 29th to October 2nd, 2009.

Note: all documents / presentations pertaining to this meeting are available via the WGAMA members’ area (NEA website http://www.nea.fr/download/gama/welcome.html ). Please note that a username + password are required to access this area. In case of problems, password can be obtained through: http://www.nea.fr/html/sendpass.pl
Appendix 1

11th WGAMA Plenary Meeting
OECD Headquarters, 2 rue André-Pascal, Paris-16, France
September 23rd – 26th, 2008

(TUESDAY, SEPTEMBER 23rd, 2008)

Part 1: General

1. Welcome, opening remarks (Chair, Secretariat).
2. Adoption of the Agenda (Chair).
3. Approval of the Summary Record of the 10th WGAMA Meeting [NEA/SEN/SIN/AMA(2007)10] (Chair, Secretariat).
4. Report on the last 2 CSNI meetings (Chair, Secretariat).
5. Integrated Plan: Update (Chair, Secretariat).
6. Overall status of WGAMA Work (Secretariat).

Part 2: Reports on WGAMA activities

7. Best-Estimate methods and Uncertainty / Sensitivity Evaluation (BEMUSE) programme:
   - Phases 4 and 5 activities: results and schedule for completion for phase 5 (F. Reventos).
   - Phase 6 activities: status and schedule for completion (F. Reventos).
8. Results of the compilation and analysis of the Questionnaire on the Use of Best-estimate methodologies (F. D’Auria).
9. CFD Code Guidelines, assessment and extension to 2-phase safety problems:
   - Writing Group 3 (extension to 2-phase) (D. Bestion).
   - Report on the Special CFD Group, including the web-based information centre on the application of CFD to Nuclear Reactor Safety (B. Smith).

(WEDNESDAY, SEPTEMBER 24th, 2008)

10. TH knowledge transfer seminar THICKET-2008 (F. D’Auria, Secretariat).
11. SA knowledge transfer seminar 2008 in collaboration with SARNET (S. Güntay, Secretariat).
12. Core Exit Temperature (CET) activity (I. Tóth).
13. Analysis of accident progression:
   - Report on “Ability of Current Advanced Codes to predict Core Degradation, Melt Progression and Reflooding – Benchmark Exercise on an Alternative TMI-2 Accident Transient” Presentation of the main results (F. Fichot).
   - WGAMA discussion and endorsement of the report.
   - Presentation of the main results.
   - WGAMA discussion and endorsement of the Report.


Part 3: Reports on Projects and CSNI Task Groups

16. Concise status reports on:
   - PKL 2 (K. Umminger).
   - Behaviour of Iodine BIP (T. Nitheanandan).
   - SERENA Phase 2 (Secretariat).
   - ThAI (H.J. Allelein).
   - SETH 2 (Secretariat).
   - PAKS (Secretariat).
   - PRISME (detailed report by IRSN).
   - PSB-VVER (Secretariat).
   - TAREF (Secretariat).
   - SM2A (Secretariat).

17. Concise status reports on:
   - PACTEL (I. Karppinen).
   - SOARCA (Ch. Tinkler).

(THURSDAY, SEPTEMBER 25TH, 2008)

Part 4: Technical Discussion on Sump Filter Clogging Issues

18. Information, presentations and discussion on Sump Filter Clogging Issues:
   - Information, including the December Workshop on Sump Filter Clogging (Secretariat).
   - Status of the Sump Filter Clogging issues since Albuquerque Workshop (J.-M. Mattéi and M. Maqua).
   - General Discussion.
   - Further actions.

Part 5: Future activities

19. Follow up of the ROSA Project (H. Nakamura, S. Güntay, Secretariat).

20. WGAMA future activities:
   - Workshop on Implementation of Severe Accident Management Measures (S. Güntay, Secretariat).
   - Possible future activities in the area of Severe Accidents (S. Güntay).
   - Possible future activities in the area of Thermal-hydraulics (I. Tóth).
Possible future activities in the area of uncertainty evaluation (F. D’Auria).
• CFD Benchmark (D. Bestion, B. Smith).
• ATLAS ISP exercise – proposal, schedule, endorsement of the CAPS (W.-P. Baek).
• General discussion.

(Friday, September 26th, 2008)

Part 6: Miscellaneous

21. Reports on selected national / international activities of particular interest to WGAMA.
22. EU and IAEA activities of interest to WGAMA:
   • SARNET (B. Clément).
   • Other.
23. Meeting summary, actions and recommendations (Chair).
24. Other matters.
25. Next meeting.
26. Closure of the meeting.
Appendix 2

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Appendix 3

HIGHLIGHTS OF THE 11th WGAMA ANNUAL MEETING
Paris, September 23-26, 2008

Item 1 Opening: The WGAMA Chairman, Ivan Tóth, opened the meeting and gave the floor to Mr. Yoshimura, the new NEA Deputy Director for Safety and Regulation. Mr. Yoshimura introduced himself and underlined the role and the importance of WGAMA activities. In particular he emphasized WGAMA cooperation with other CSNI Working Groups and expressed his interest to attend the WGAMA discussion on new activities and proposals. The WGAMA Chairman welcomed the new delegates and the new Secretariat who were invited to introduce themselves.

Item 2 The Agenda was adopted, although the order of some items was changed to fit specific requests.

Item 3 The Summary Record of the WGAMA 10th Meeting [NEA/SEN/SINAMA(2007)10] was approved.

Item 4 The WGAMA Chairman reported on the last two CSNI meetings. He focused on the achievements of the WGAMA, the activities approved by the CSNI and the cooperation with other CNRA or CSNI Working Groups. In particular, he underlined the CSNI satisfaction regarding the successful completion of the two seminars dedicated to knowledge transfer (EU-SARNET/OECD Joint Training Course on Nuclear Reactor Severe Accident Analysis and THICKET-2008).

Item 5 The Secretariat provided short information on the update of the WGAMA Integrated Plan. It is proposed to update the Integrated Plan after the WGAMA Meeting discussion, on an annual periodicity basis.

Item 6 The presentation regarding the status of WGAMA activities was made by the Secretariat. It addressed the current WGAMA activities and the status of their achievement as well as the requests for WGAMA endorsement before submission to PRG/CSNI.

Item 7 F. Reventos reported on the status of BEMUSE Phase 5 and the orientations for the synthesis report expected for Phase 6. The WGAMA discussed the BEMUSE Phase 5 status and decided to postpone to April 2009 the submission of the related report in view of its better completion. The final version of the report should be distributed to WGAMA by the end of 2008. Consequently, the BEMUSE Phase 6 report will be submitted to PRG in Autumn 2009. Both reports will be submitted to WGAMA for endorsement and will go through an independent review by A. Bucalossi for Phase 5 report, and USNRC for Phase 6 report.

Item 8 F. D'Auria gave an overview of the answers received so far to the Questionnaire on the Use of Best-estimate Methodologies. From the long discussion which followed, three main ideas emerged:

- the need for a coordination of WGAMA activities in the area of BEPU with the OECD/NEA/NSC UAM activity in order to ensure synergy as much as possible;
- the need of a “standard” or at least harmonization among Best-estimate Methodologies;
- for the probabilistic methods: a benchmark of methods to determine the uncertainties of the key input parameters in order to justify the assumptions made on their uncertainty in the propagation step.
However, it was agreed to postpone the decision for future activities after the issuance of BEMUSE Phase 6 report.

**Item 9**

B. Smith reported on the Special CFD Group activity, in particular the web-based information centre on the application of CFD to Nuclear Reactor Safety. In this respect, the Secretariat was requested to coordinate with the NEA Webmaster to give Brian access to navigation bars and to provide help for the implementation of the pictures and videos.

The report of D. Bestion covered the programme, the participation, the panel session and the conclusions of the XCFD4NRS Workshop held in Grenoble on September 10-12, 2008. The WGAMA Chairman underlined the quality of the Workshop and thanked D. Bestion and the Organizing Committee for their efforts. The Secretariat was requested to distribute the Workshop CD-ROM to all WGAMA members.

USNRC is interested to host the next CFD Workshop which will take place in 2010. The related CAPS should be prepared by J. Mahaffy and S. Bajorek, distributed to WGAMA for final endorsement and submitted to PRG for approval during its October 2008 meeting.

D. Bestion reported on the status of the CFD extension to 2-phase activity. Due to his heavy involvement in the XCFD4NRS Workshop, some parts of the report are still missing. However, a draft report is expected to be ready end of December 2008. It will be distributed in parallel to M. Réocreux for independent review and to WGAMA for endorsement before submission to PRG in April 2009.

**Item 10**

A. Del Nevo gave an overview of the THICKET-2008, addressing the participation, the programme and the main outcome. The WGAMA discussed the major remarks made by the participants in their assessment of the THICKET-2008. Concerning the next THICKET, the Group took note of the offer of the Turkish Atomic Energy Commission (TAEK) to host it. The Secretariat was requested to coordinate with TAEK, to formulate a CAPS and, as soon as possible, to circulate it to WGAMA for endorsement and to PRG for approval. The EC and the IAEA representatives expressed their organizations willingness to co-organize such activity and to help cover the cost of participants from eligible countries.

**Item 11**

S. Güntay, WGAMA Vice-Chairman, presented the key points of the Training Course on Nuclear Reactor Severe Accident Analysis, jointly organized by the EU-SARNET and the OECD-NEA, in Budapest on April 7-11, 2008. After discussion of the outcome, it was decided to coordinate with SARNET the organization of a follow-up meeting and to bring a clear proposal for the next WGAMA annual meeting.

**Item 12**

I. Tóth, chair of the Core Exit Temperature (CET) effectiveness Task Group, provided the status of this Task which started early 2008. He reported on the outcomes of the two meetings held respectively on April 24-25 and September 22nd. The whole activity is proceeding according to schedule.

**Item 13**

F. Fichot, coordinator of the activity on analysis of accident progression, presented the main results of the related report entitled “Ability of Current Advanced Codes to predict Core Degradation, melt Progression and Reflooding – Benchmark Exercise on an Alternative TMI-2 Accident Transient”. All the comments made by WGAMA members and by the independent reviewer (J. Martinez) were considered. After discussion, the report was endorsed by WGAMA and will be submitted to PRG for approval during its next October meeting.
Item 14  H.J. Allelein, coordinator of the Writing Group of the State-of-the-art report on nuclear aerosols confirmed the completion of the report; he emphasized the important work made to revise and to structure both the chapter 8 and the Executive Summary. B. Clément, independent reviewer of the report, recalled his independent review and went through his comments which have been implemented in the last version. After discussion, the WGAMA endorsed the report which will be submitted to the PRG for approval during its October meeting.

Item 15  H.J. Allelein, coordinator of the Containment Computer Validation Matrix (CCVM) recalled the status of this task which did not progress for years. After a discussion whether the WGAMA has to pursue the activity, it was concluded to complete it by producing a report which describes the tests available. For that end, it was proposed to establish a small group including IRSN, Canada and Germany. The test owners countries were asked if they can back-up the activity completion and this was confirmed. The Secretariat was requested to take contacts and to coordinate with H.J. Allelein and with the Chairs.

Item 16  Reports on Projects and CSNI Task Groups activities relevant for WGAMA were provided. In particular, M. Faury (IRSN) gave a detailed presentation of PRISME Project while the Secretariat provided an update of other projects relevant for WGAMA activities. As far as cooperation with the SM2A CSNI Task Group is concerned, the Secretariat is requested to coordinate between WGAMA and SM2A Chairs in order to clearly define the support expected from WGAMA.

Item 17  I. Karppinen and S. Bajorek provided concise status reports respectively on PACTEL facility and SOARCA project. PACTEL is being adapted for PWR and series of tests, including characterizing tests is in progress. The preliminary findings of SOARCA project show that, thanks to the 25 year knowledge progress, some measures have potential to prevent or significantly delay core damage.

Item 18  The Secretariat provided an introduction to the Sump Filter Clogging Issues, with a focus on the outcome of the Workshop organized in Albuquerque in February 2004. The WGAMA members were also informed about the upcoming Workshop which will be organized by the CNRA on December 4-5, 2008.

B.M. Pütter (GRS) made an overview on debris impact on Emergency Coolant Recirculation addressing the related findings and requirements in Germany, some international findings and topics and required investigations likely to enhance knowledge for safety demonstration. He also presented the knowledge base for “sump clogging” being developed by GRS/BMU.

V. Borzov (IRSN) provided a similar presentation with a focus on IRSN experimental programme performed on chemical effects.

From the discussion focusing on whether WGAMA can handle a work in this field, it was concluded that:

- The WGAMA Chairman and the Secretariat will report to the next WGAMA annual meeting about the December Workshop;
- It is necessary to wait for the outcomes of the presentations to CNRA and CSNI, and then to formulate a proposal to the next WGAMA meeting. The proposal will be prepared by the USNRC.

Item 19  H. Nakamura and S. Güntay made two presentations in support to the continuation of ROSA project with the main objective to investigate reflux cooling under DBA and severe accident transient conditions through a coupling between ROSA /LSTF (for integral system response) and
ARTIST/RFLX. The member countries had the opportunity to express their interest to participate in this project during the dedicated expert meeting on September 26th, following WGAMA meeting. S. Bajorek who was not able to attend that expert meeting expressed USNRC interest in the continuation of ROSA but had to report to his Management; final decision depends upon the availability of funds.

**Item 20** This Agenda item included the views of the Chairman and the Vice-Chairman respectively on possible future activities in the area of Thermal-hydraulics and possible future activities in the area of Severe Accidents.

Several concrete proposals were made:

- **CFD Benchmark**: The WGAMA endorsed the principle to launch within one year a CFD Benchmark using Vattenfall T-junction. The corresponding CAPS has to be submitted to PRG for approval during its October 2008 meeting, after final endorsement by WGAMA members.

- **Advanced reactors**: following the presentation made by S. Bajorek (USNRC), the group agreed to wait for the outcome of the next TAREF meeting (November 2008) and to propose a CAPS for a Knowledge Management Workshop on Advanced Reactors. This CAPS should be submitted to PRG for approval in April 2009.

- **ATLAS ISP**: the proposal is based on DVI (Direct Vessel Injection) break scenario and the ISP will last 2 years. The related CAPS has to be submitted for PRG approval during its October 2008 meeting, after final endorsement by WGAMA members.

- **In-Vessel Coolability Workshop**: The Workshop is proposed to take place early September 2009 in Cadarache; so to allow to report to the Workshop on Implementation of Severe Accident Management Measures. The organization will be ensured by IRSN, with PSI support. The related CAPS has to be submitted for PRG approval during its October 2008 meeting, after final endorsement by WGAMA members.

- **ISP on Hydrogen Deflagration**: It is proposed to launch an ISP on Hydrogen Deflagration using test results from the French small scale facility ENACCEF and the German ThAI facility. The ISP is expected to last 16 months once launched. The related CAPS has to be submitted for PRG approval during its April 2009 meeting, after endorsement by WGAMA members.

- **Best-estimate Guidelines for Lumped Parameters Analysis of Containment Thermal-hydraulics**: The Secretariat is requested to send out an e-mail to WGAMA members requesting nominations for a special group dedicated to this activity. The CAPS has to be prepared and circulated to WGAMA members for comments prior to the submission to the PRG for its April 2009 meeting.

- **Aerosol source term, mitigation, Level 2, uncertainties**: It is proposed to organize a Workshop focusing on aerosol source term, mitigation, Level 2 and uncertainties. The CAPS will be drafted by H.J. Allelein with support from S. Güntay and B. Clément. H.J. Allelein offered to host the Workshop; IRSN will check if it can take the lead. The related CAPS has to be prepared and circulated to WGAMA members for comments prior to the submission to the PRG for its April 2009 meeting.

- **Follow-up of the TMI-2 Benchmark**: The report on “Ability of Current Advanced Codes to Predict Core Degradation, melt Progression and Reflooding – Benchmark Exercise on an Alternative TMI-2 Accident Transient” recommends to continue such benchmark exercises and to involve more users and more codes. It was proposed to use the report “reference
scenario” to investigate the effects of SAM actions and estimate the confidence in using codes to predict the consequences of SAM actions. It was agreed that the interested organizations will coordinate and bring a proposal to the next WGAMA annual meeting.

**Item 22** B. Clément provided an update of SARNET. He summarized SARNET achievement from April 2004 to September 2008. He informed about the follow-up in the frame of SARNET 2 which is in final negotiation with the European Commission. SARNET 2 is intended to focus on few targeted research needs; scientific research will cover six high level priority issues as defined in SARNET and will be organized in 4 work packages: corium and debris coolability, molten corium concrete interaction; containment and source term.

S. Lee presented an overview of IAEA activities on safety analysis and accident management. He addressed relevant IAEA safety standards, new publications and relevant activities for 2007/2008.

**Item 23** The WGAMA Chairman summarized the meeting actions and recommendations as follows:

<table>
<thead>
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<th>Activity</th>
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<td>• State-of-the-art report on nuclear aerosols</td>
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</tr>
<tr>
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30
● Training course on SA  
To coordinate with SARNET and to bring a proposal for the next WGAMA annual meeting.

● Sump filter clogging  
To wait for the outcomes of the presentations to CNRA and CSNI; USNRC will coordinate with WGAMA for CAPS preparation.

● Follow-up of TMI-2 Benchmark  
The interested organizations will coordinate and bring a proposal to the next WGAMA annual meeting.

**Item 25** The next WGAMA meetings will be held from September 29th to October 2nd, 2009.
Appendix 4

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