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English - Or. English

NUCLEAR ENERGY AGENCY
COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS

NEA/SEN/SIN/IAGE(2008)2
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Working Group on Integrity and Ageing of Components and Structures (IAGE WG)

Subgroup on the Ageing of Concrete Structures

Summary Record of the 13th Meeting

OECD Headquarters, Paris, France
March 31, 2008

English - Or. English

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Summary Record of the 13th Meeting of the
Integrity and Ageing of Components and Structures Working Group (IAGE)
Sub-group on the Ageing of Concrete Structures

OECD Headquarters
Paris, France
March 31 2008

Main actions taken

Action 13-1 NEA to submit the report on a decade of activities in the area of ageing of NPP concrete structures to the IAGE main group for approval.

Action 13-2 Member Countries to identify by end of April relevant experts in their countries and send the corresponding expert information (i.e. name, organisation, address, telephone and e-mail) to the NEA Secretariat in order to send an official invitation letter to participate at the workshop on Ageing Management of Thick Walled Concrete Structures, including ISI, maintenance and repair – Instrumentation methods and Safety Assessment in view of Long Term Operation.

Action 13-3 Regarding the proposal on Improving robustness assessment of structures impacted by a large missile at high velocity, NEA Member countries will identify which models are available to simulate the airplane crash. This information will be send to Dr. Jean Mathieu Rambach (Mathieu.rambach@irsn.fr) and Mr. Luc De Marneffe (luc.demarneffe@tractebel.com) with copy to the NEA Secretariat by the end of April.

Action 13-4 Dr. Jean Mathieu Rambach and Mr. Luc De Marneffe will review and reword the proposal on improving robustness assessment of structures impacted by a large missile at high velocity in order to clarify the data available of the previous test, the simulation models available and to stress the fact that the activity will be focused on technical aspects and will not provide information that could be used for malevolent use. The new version of the proposal will be circulated to the Member Countries for comments. Members will discuss with their upper managers about the proposal in order to get consensus on how to proceed.

Action 13-5 Regarding the future Concrete programme of work, it was agreed:

- Finland (Dr. Pentti Varpasuo) will write a proposal to write a CAPS for addressing the pre-stressing losses and corrosion protection.

- It was mentioned that a CAPS should be written to address Long Term of Operation. New NPP are now designed with a life time extended to 60 years or more. The implications of this longer period of operation should be discussed by the sub-group: design, monitoring, corrosion, concrete formulation, hardware replacement.

- It was agreed to make a small survey and circulate it by e-mail in order to identify those member countries RI-ISI applications for containment structures. Based on the results of the survey the group could include an item in the agenda for the 2009 meeting on this topic.

- It was agreed to review the CSNI report on NDE during the workshop on October 2008 with the objective to assess its updating.

- Based on the expansion of the IAGE mandate to cover new reactors, it was agreed to establish contact with Gen IV in order to assess the feasibility to produce a SOAR on design on containments for new concepts/generic principles for design of new concrete structures.

Action 13-6 Mr. Andrei Blahoianu, IAGE Chairman, informed that the SMIRT 20 international conference will take place in Finland next year. In order to promote the visibility of the IAGE group, it was agreed that the IAGE main group and sub-groups chairs will prepare abstracts describing the work of the IAGE main group and sub-groups to be submitted to the conference.

Summary

1. The 13th meeting of the CSNI Integrity and Ageing of Components and Structures/Subgroup on the Ageing of Concrete Structures took place March 31, 2008 at the OECD Headquarters, Paris, France.

2. The Chairman, Dr. Les Smith, opened the meeting and welcomed the participants.

3. Each participant introduced himself.

4. The list of participants is in Appendix 1. Apologies for absence were received from: Mr. Rudiger Danish (Areva NP GmbH, Germany), Ms. Sara Cardellicchio (Sogin S.p.a, Italy), and Ms. Behnaz Aghili (SKI, Sweden).

5. New membership includes Dr. Kenta Hibino (JNES, Japan), however, he was not able to attend and was replaced by Mr. Yuichi Uchiyama (JNES, Japan), and Mr. Daniel Guilbaud (CEA, France).

6. Members adopted the preliminary agenda NEA/SEN/SIN/IAGE/A(2008)1.

7. Members approved the Summary Record of the 12th Meeting of the IAGE Subgroup on the Ageing of Concrete Structures NEA/SEN/SIN/IAGE(2007)4.

Report by secretariat

8. Mr. Alejandro Huerta, the NEA Secretariat, provided information regarding the activities of the Committee on Nuclear Regulatory Activities (CNRA), the Committee on the Safety of Nuclear Installation (CSNI), and the Multinational Design Evaluation Programme. He informed that the CSNI updated regularly an Activities Report, which describes in detailed all the working groups' activities with focus on recent progress. The report also includes the status of the joint international projects sponsored by the CSNI. He then introduced the completed activities and the current activities of all the CSNI working groups.

9. The CSNI decided, as a result of the Forsmark NPP event in 2006, to undertake a task to assess the Defence in Depth of Electrical Systems and Grid Interaction with the objective to prepare a document establishing guidelines in the robustness of safety related electrical systems and interaction with grid.

10. Mr. Huerta informed the CNRA approved publication of the new "green booklet" on The Regulatory Goal of Assuring Nuclear Safety. The primary focus of this report is on how the regulatory body can systematically collect and make an integrated analysis of all the relevant safety information available to it and arrive at a sound judgement on the acceptability of the level of safety of the facilities that it regulates. Then the completed and current activities of each of the CNRA working groups were described, including the new CNRA working group on the Regulation of New Reactors. Mr. Huerta also noted that the CNRA approved the programme of the workshop on Lessons Learned from Sump Pump Clogging Issues that will take place December 4-5, 2008 at the OECD Headquarters.

11. Mr. Huerta described the results of the Multinational Design Evaluation Programme Stage 2 Pilot Project. The goals of MDEP Stage 2 were to establish reference regulatory practices and regulations to enhance the safety of new nuclear reactor designs, and increase cooperation among regulators to improve the effectiveness and efficiency of the regulatory design reviews. The scope of the Pilot Project included the assessment of similarities and differences in the regulatory requirements and practices of the participating countries in the following areas: Licensing basis, design review, safety goals, and in component manufacturing oversight. The proposed structure for the continuation of MDEP was presented including the design specific working groups (currently EPR and AP1000) and the issue specific working groups.

12. Finally, Mr. Huerta reviewed the list of actions of the 12th meeting of the IAGE sub-group on ageing of concrete structures. Indicating that all of the actions were either completed or under different items of the agenda.

Update on any development in programmes and policies in member countries (round table) including presentations on items of interest

13. Dr. Etienne Gallitre (EdF) made a presentation on a National Project called "CEOS.fr" on the behaviour and assessment of special structures (cracking and shrinkage). Specific scientific themes include cracking under monotonous loading, behaviour under thermo-hydrous loading, and cracking under cyclic loadings. The project will last about four years. The objective at the beginning is to assess the crack pattern, while the long term objective is to assess leakage rate through the concrete.

14. Dr. Syed Ali (NRC) made a presentation on the research activities related to concrete in the USNRC. He described the experience with the concrete modelling with LS-DYNA code, the research related to transportation casks, and the state-of-the-art reactor consequence analysis (SOAR-CA) project. Dr. Ali also informed about the development of new Regulatory Guides on containment performance assessment and on seismic margin assessment, as well as the revision of some others guides, such as RG 1.136 for designs limits, loading combinations, materials, construction, and testing of concrete containments. He then described the research activities related to the high temperature effects on concrete aimed to investigate the effects of long-term thermal loadings at moderate temperature level, and the research on cementitious materials. Dr. Ali then noted the presentations on concrete aspects included in the NRC/DOE Workshop on U.S. Nuclear Power Plant Life Extension R&D, Life Beyond 60, Future Potential Research for Concrete in NPPs. He informed that the workshop proceedings with all the presentations can be accessed from the website http://www.energetics.com/nrcdoefeb08/.

15. It was also informed that Dr. Dan J. Naus from Oak Ridge National Laboratory is developing a report for the DOE on the Inspection of Nuclear Power Plant Structures – Overview of Methods and Related Applications.

16. Following a question, Dr. Ali informed that the NRC issued a draft rule for the assessment of NPP to aircraft impact, considering a large commercial aircraft at normal speed. In the published version of the draft rule the aircraft impact assessment was not required for plants already certified. One of the major public comments was that the rule should also apply to plants already certified. Currently the NRC is re-considering whether the rule should also be

applied to plants already certified. The Commission's final decision in this regard will be reflected in the final rule which is scheduled to be published in December 2008.

17. Dr. Pentti Varpasuo (Fortum) made a presentation and distributed a paper on the numerical simulation of small scale soft impact test. The purpose of the test program is to provide data for the calibration of the numerical simulation models for impact simulation. The behaviour of the impact target is the second investigative goal of the test program. The response of re-inforced and pre-stressed concrete walls is studied with the aid of displacement and strain monitoring.

18. A round table ensued regarding an updating of the development of programmes and policies:

Belgium	Project under way on ageing management of NPP concrete structures.
Canada	Several plants are under refurbishment with some civil work. Canadian industry announced potential new builds. Containment with liner has been considered.
Korea (Republic of)	20 units in operation and 6 under construction. Construction permit for a low to intermediate waste disposal. Renewal of licensee for 10 years for Kori unit 1.
United States of America	Rulemaking for aircraft impacts. 4 applications for site permit, and 11 new applications for combined license (COL).
Finland	SAFIRE Project underway, including 3 projects: impact of soft missiles, structures under seismic loads and service life management.
France	IRSN R&D activities on leakage trough containment, creeping of containment, NDE methods using ultrasonic waves in tendons to evaluate loss of pre-stressing force.
Japan	55 plants. Periodic review of concrete and mechanical components each 10 years (after 30 years of operation).
Czech Republic	Test to minimise leakage of containment. Penetration's polymer was not able to be detected.

Final synthesis report on containment activities

19. The Chairman informed that according to the agreement reached at the 12th meeting of the concrete sub-group, he reviewed the synthesis report on "A decade of activities in the area of ageing of NPP concrete structures" and wrote down some paragraphs to address the comments of the IAGE main group. The report contains a summarisation of conclusions drawn from a series of workshops conducted to address specific technical issues related to

ageing of NPP concrete structures. The report was circulated to all the IAGE main group and concrete sub-group for comments.

20. It was informed that positive comments have been received about the report. The concrete sub-group endorsed the report and it was agreed to submit it to the IAGE main group for approval.

Workshop on ageing management of thick walled concrete structures, including ISI, maintenance and repair – Instrumentation methods and safety assessment in view of long term operation

21. Dr. Ladislav Pecinka presented the status of the organisation of the workshop, including logistics, hotel accommodations and workshop venue. The workshop will take place at the Holiday Inn at Prague, Czech Republic on October 1-3, 2008. The workshop will be hosted by the Nuclear Research Institute Rez.

22. The objective of the workshop is to present state-of-the-art techniques for the integrity assessment of concrete structures and to recommend areas in which further research is needed. Special emphasis will be given to performance-based in-service inspections (ISI) based on non-destructive evaluation (NDE) methods (such as impact echo, ultrasound and high frequency radar) and instrumentation. The limits of applicability will be extensively discussed. The management of ageing programmes based on suitable structural monitoring will also be addressed in the framework of a safety assessment of the installations in the long term. Probabilistic methods oriented towards the reliability of structural assessments will be compared and suggestions will be made for the consistent management of the integrity assessment of civil structures, both repairable and non-repairable.

23. Mr. Huerta informed that the announcement has been issued, and the workshop website is running, with the possibility to register on-line and send the abstracts to the address http://www.nea.fr/html/nsd/workshops/concrete/index.html. He then encouraged all the members to promote the participation in the workshop, and especially all the workshop organising committee to propose invited lecturers and proposed a preliminary workshop programme.

24. A discussion ensued with the following highlights:

    a. The main focus of the workshop should be on safety assessment of the containment.

    b. Dr. Syed Ali mentioned that he would invite Dr. Dan Naus from Oak Ridge National Laboratories and Dr. Charles Hofmayer from Brookhaven National Laboratory, USA.

    c. Dr. Paolo Contri to identify and look for the EC JRC support for European invited lecturers.

    d. Papers could be prepared by for example, France on internal inspection.

    e. Include the problem of the liner corrosion in the workshop programme as well as the corrosion of re-inforced concrete.

Improving robustness assessment of structures impacted by a large missile at high velocity

25. Dr. Jean Mathieu Rambach made a presentation of the proposal developed by himself and by Mr. Luc de Marneffe on "Improving robustness assessment of structures impacted by a large missile at high velocity". He informed that the objectives are: to propose a mean to facilitate the technical exchanges regarding the robustness assessment of nuclear facilities impacted by commercial airplanes without producing detrimental results for those facilities; to develop and improve simulation tools of airplane crash on nuclear facilities based on tests interpretation; and to share the experience of simulation by open benchmarks.

26. It was noted that public acceptance of existing and forecast nuclear facilities depends on the demonstration capacity, from Safety Authorities, TSO and Operators, to prevent and mitigate the effects of intentional crashes of commercial aircrafts.

27. Several types of structures are to be considered such as elementary structures (beams and slabs), rounded reactor building like structures of reduced size and box-shape structures of reduced size, subjected to the impact of soft impactors. These impactors may be characterised by mass distribution along missile axis and crushing strength distribution along missile axis. Different modelling tools are to be used of the most various types such as fast dynamic finite element codes, finite difference codes, simplified and/or analytical methods for beams and slabs.

28. Three successive round robins are proposed: 1st round robin limited to impacts on elementary structures, 2nd round robin devoted to buildings of reduced size, and the 3rd round robin devoted to the transmission of shock vibrations on the envelope and inside the internal structures. No new tests are going to be performed but re-interpretation of previous tests with published or declassified data and results. Each round robin has to be concluded by a workshop where each "competitor" may present its results. A state-of-the-art report collecting the contributions and proposing synthesis and recommendations for good practices may be addressed.

29. A discussion ensued with the following highlights:

    a. Requirements for previous test to avoid any testing. Maybe not all the data is available, so the first task is to assess the available experimental information.

    b. It was agreed that member countries will identify which models are available to simulate the airplane crash.

    c. While some countries have expressed support to the proposal, some others (USA, UK) expressed concern that in an open forum the results can get into wrong hands. For this countries safety issues are important, but, the security aspects are even more important.

    d. The proposal should be focused on the safety assessment and pragmatic applications. Also important is the assessment of the consequences in terms of fire, explosions, etc. Important is the transmission of shock and vibrations on the envelope and inside the internal structures, along with secondary effects.

e. It was agreed that members will discuss with their upper managers about the proposal in order to get consensus on how to proceed.

f. It was agreed that the proposal will be reviewed and reworded in order to clarify the data available of the previous test, the simulation models available and to stress the fact that the activity will be focused on technical aspects and will not provide information that could be used for malevolent use.

g. It was also agreed that a technical meeting could be called before the CSNI meeting in December 2008 to further discuss the proposal.

IAGE concrete sub-group programme of work

30. Dr. Leslie Smith mentioned that the Concrete sub-group has only two main activities. The one related with the workshop on Ageing Management of Thick Walled Concrete Structures, including ISI, maintenance and repair – Instrumentation Methods and Safety Assessment in view of Long Term Operation, and the activity related with the proposal on improving robustness assessment of structures impacted by a large missile at high velocity. In consequence, the sub-group should define new activities that are of interest to all the member countries.

31. He also informed that a RILEM NUCPERF 2009 Workshop on Long Term Performance of Cementitious Barriers and Re-inforced Concrete in Nuclear Power Plants and Waste Management will take place on 30 March – 2 April 2009. The NEA/CSNI is scientific sponsor of the workshop. Deadline for abstracts submittal is November 2008.

32. The medium term strategies of the IAGE Concrete sub-group were reviewed with the idea to identify potential new activities based on the Table A that prioritise the issues identified by the sub-group.

33. A discussion ensued with the following highlights:

a. Finland (Dr. Pentti Varpasuo) will write a proposal to write a CAPS for addressing the pre-stressing losses and corrosion protection.

b. It was mentioned that a CAPS should be written to address Long Term of Operation. New NPP are now designed with a life time extended to 60 years or more. The implications of this longer period of operation should be discussed by the sub-group: design, monitoring, corrosion, concrete formulation, hardware replacement.

c. It was agreed to make a small survey and circulate it by e-mail in order to identify those member countries RI-ISI applications for containment structures. Based on the results of the survey the group could include an item in the agenda for the 2009 meeting on this topic.

d. It was agreed to review the CSNI report on NDE during the workshop on October 2008 with the objective to assess its updating.

e. Based on the expansion of the IAGE mandate to cover new reactors, it was agreed to establish contact with Gen IV in order to assess the feasibility to produce a SOAR on design on containments for new concepts/generic principles for design of new concrete structures.

Cooperation with other international organisations

34. Dr. Paolo Contri of the European Commission, Joint Research Centre, Petten provided a brief overview of the Safe Operation of Nuclear Installation (SONIS) action plan to address operational issues, maintenance optimisation, seismic and human factors. He informed that the report on integrity of components and operational safety is available at JRC website www.jrc.nl. He described a European model for life management, based on the Finish approach, especially from Lovisa NPP. Finally, he noted that a project called NULIFE, chaired by VTT, is addressing design issues, and involves many stakeholders such as utilities, vendors, etc. The project is mainly focused on metal components. He noted that at European level the focus on research is on operational safety issues (life management, maintenance optimisation, control of HF, operational feedbacks, etc) and on Generation IV.

Any other business

35. Mr. Andrei Blahoianu, chairman of the IAGE working group mentioned that in order to submit a CAPS for approval to the CSNI a clear identification of the lead organisation and resources needed is required.

36. He also informed that the SMIRT 20 international conference will take place in Finland next year. In order to promote the visibility of the IAGE group, presentations should be prepared by each IAGE main group and sub-groups chairs with the support of the NEA Secretariat.

Next meeting

37. It was agreed by all the members that the IAGE meetings will take place the week of April 20-24, 2009. This date is tentative and will be subjected to the IAGE main group decision.

38. The chairperson, Dr. Leslie Smith thanked the members for their active participation during the meeting and then closed the meeting.

APPENDIX 1: LIST OF PARTICIPANTS

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