

IAEA-EBP-LTO-27

031105

**EXTRABUDGETARY PROGRAMME
ON
SAFETY ASPECTS
OF LONG TERM OPERATION
OF WATER MODERATED REACTORS**

MINUTES OF THE 4th Meeting of Working Group 2

Vienna, Austria October 31 to November 2, 2005

INTERNATIONAL ATOMIC ENERGY AGENCY

1. INTRODUCTION

The number of Member States giving high priority to extending the operation of nuclear power plants beyond their initial license is increasing. Decisions on long term operation (LTO) involve the consideration of a number of factors. While many of these decisions concern economic viability, all are grounded in the premise of maintaining plant safety. The IAEA recognized this new industry initiative; therefore, in the 1990's, it developed comprehensive generic guidance on how to manage the safety aspects of physical ageing. It was recognized, however, that internationally agreed-upon, comprehensive guidance was needed to assist regulators and operators in dealing with the unique challenges associated with the LTO issue.

In response, the IAEA initiated this Extrabudgetary Programme (Programme) on Safety aspects of long term operation of water moderated reactors (original title was Safety aspects of long term operation of pressurized water reactors). The Programme's objective is to establish recommendations on the scope and content of activities to ensure safe long term operation of water moderated reactors. The Programme should assist regulators and operators of water moderated reactors, and, in particular WWERs, in ensuring that the required safety level of their plants is maintained during long term operation, should provide generic tools to support the identification of safety criteria and practices at the national level applicable to LTO, and should provide a forum in which MS can freely exchange information.

The Programme activities are guided by the Programme Steering Committee (SC), follow the overall SC Programme Workplan and SC Terms of Reference, [1], and are implemented in 4 Working Groups (WG). The WGs focus on:

- general LTO framework (WG 1);
- mechanical components and materials (WG 2);
- electrical components and I&C (WG 3);
- structures and structural components (WG 4).

Further detailed information on the Programme could be found at: http://www-ns.iaea.org/nusafe/s_projects/salto_int.htm .

In mid 2005 the Programme activities entered the final phases. To co-ordinate the effort, A WG leaders and secretaries meeting was organized by the Agency and hosted by PNNL at its Seattle office, 26-29 September 2005. The objectives of the meeting were:

- to review and consolidate the outcomes of the activities conducted within the Programme to date,
- to co-ordinate the preparation of the Final Working Group Reports,
- to initiate the development of the Final Programme Report, and,
- to establish a basis for a Safety Guide on long term operation.

The Agenda for the Meeting is provided in Appendix I. The list of participants is provided in Appendix II and the presentations made during the meeting are provided in Appendix III. ???

2. MEETING SUMMARY

Mr. Radim Havel, the Programme Scientific Secretary, opened the meeting, and outlined the expected outcomes from the meeting which were:

- Provide the WG2 members an overview of the results of the WG Leaders/Secretary meeting held in Seattle
- Review the second draft of the Working Group 2 and develop a resolution for any conflicting opinions a
- Review and comment on the Table of Contents for the Final Program report
- Provide input to IAEA on potential follow-on activities and
- Agree to a schedule to complete the final draft by November 18 in order to submit the final draft to the IAEA secretary by December 5, 2005.

2.1 Review of the Draft Working Group 2 Report

Mr. Taylor lead the discussion during the review of the draft WG2 report. The review was conducted by discussing each section of the report.

During the discussion of the report the following points were agreed upon.

Introduction

Mr. Taylor clarified that the Working Group reports were to be stand alone separate reports and as such should contain an introduction. There were no significant comments the introduction as drafted. Mr. Taylor agreed to review the introduction from an editing point of view.

1.0 Requirements

There were no significant comments on Section 1.0

2.0 Scoping of Systems Structures and Components

In Section 2.3 Future Challenges, it was noted that there was no definition for Safety Margins. It was agreed that the report would be revised to include a Glossary of Terms, that IAEA definitions would be used in defining terminology and that the Glossary contained in SALTO report XXXXX LTO-03 would form the basis for the Glossary.

In Section 2.4 Recommendations it was agreed to include training as part of the recommendations.

3.0 Aging Management Programs

In Section 3.1.2 **Ageing Mitigation Measures** it was agreed to add a sentence that states the concept that early implementation of mitigation measures is critical and then reference the Tables in the Appendix. It was also agreed to Reference IAEA TECDOCs as appropriate to WG2.

4.0 Operational Programs

Section 4.1.3 Identification of Future Challenges it was agreed to add the following sentence - In particular the ISI program should ensure that the inspection methods specified by the ISI program are capable of detecting and characterizing the aging effects for outside and inside of the SSC.

Section 4.2.4 Recommendations: It was agreed to revise section 4.2.4 Recommendations as follows.

The members of Working Group 2 provide the following recommendations in the area of maintenance:

- Maintenance activities shall be based on national regulatory body legislation and complied with international standards;
- The process for developing maintenance programs for LTO should be a pre-condition. This process should clearly address the type of maintenance (preventive, predictive and corrective), the links with ageing management programs, the frequency and tasks, the records, their evaluation and storage in view of the optimization of the maintenance programs;
- Monitoring of the effectiveness of the maintenance activities is recommended for addressing maintenance optimization. IAEA should help to facilitate the development of international standards that enable the effectiveness of maintenance practices to be evaluated;
- International cooperation should be encouraged to promote advanced methods and tools for predictive maintenance.
- International cooperation should encourage in developing a set of minimum Risk Based Criteria for those countries that use Risk Based maintenance

Section 4.5 Applied Diagnostic Systems: Sections 4.5 Applied Diagnostic Systems and Section 4.9 Load Monitoring Systems have elements that overlap. It was agreed to merge the two Sections into Section 4.5. Mr. Taylor was requested to discuss this subject in the upcoming WG3 meeting.

4.6 Surveillance specimen programs: It was agreed that this section needed to be revised. Claude Reig, Teodora Ribarska and Vladimir Piminov agreed to revise this section by November 9, 2005.

4.7.3 Identification of Future Challenges: It was agreed to revise section 4.7.3 as follows.

Working group 2 members believe that the major challenges in the area of non-destructive measurement of material properties are as follows.

- Development of robust NDE technology to measure the following material conditions (Provide a list that prioritizes the techniques in terms of potential for success)
 - void swelling
 - embrittlement
 - Fatigue damage
 - Local stress in components
 - Local strain that could be used to monitor loss of pre-load
- Development of minimum criteria for regulatory acceptance of NDE material property measurements

4.7.4 Recommendations: It was agreed to revise section 4.7.4 as follows.

Working group 2 members recommend the following:

- Technical exchange meetings in the area of NDE material property measurements
- Agree upon benchmarking protocol for measuring the capability of NDE methods
- Development of criteria that regulators may use in evaluating the acceptability of NDE material property measurements

Section 4.8.1 Background: It was agreed to revise Section 4.8.1 as follows.

All MS participating in the SALTO project conduct destructive tests to determine material properties for SSCs in the scope of LTO. The destructive testing methodology is based upon international standards such as ASTM or GOST standards. Typical destructive analysis that are performed at nuclear power plants include:

- Metallographic analysis of failed material to determine type of cracking
- Impact Charpy and Fracture toughness (for application of Master Curve) Tests for material properties of vessel surveillance specimens
- Metallographic analysis of vessel material for Void swelling
- Fatigue testing
- Tensile testing

5.2 Common Elements and Differences: It was agreed to revise the section on Fracture Mechanics as follows:

Fracture Mechanics Analysis

This TLAA involves the fracture mechanics analysis of plant passive components within the scope of LTO. Typical components that require fracture mechanics analysis include:

- Piping Leak-Before-Break Analysis (depending upon design and regulatory requirements)
- Component / Piping Indication Analysis

It was agreed to add the section on Thermal Aging below.

Thermal Aging

Examples of components that require thermal aging analysis include:

All components in the reactor coolant pressure boundary

Section 5.3 Identification of Future Challenges: Section 5.3 was revised as follows.

Working Group 2 members identified the following challenges for TLAAs:

- uncertainties in the material properties of for SSCs in the scope of LTO, even given the surveillance, monitoring and trending programs used in nuclear power plants
- Developing analytic techniques that account for the impact of improved inspection methodology

Working group 2 members believe that the major challenge in the area of TLAA's involves developing minimum standards for methodology and acceptance criteria.

Section 5.4 Recommendations: Section 5.4 was revised as follows.

Working Group 2 members recommend the following actions to improve TLAAAs.

- Sharing international experience on material property for SSCs in the scope of LTO, this could include a database of material property measurements
- Working group 2 members recommend that IAEA facilitate development of minimum standards specific to applicable of LTO for TLAAAs.
- In order to improve the accuracy of TLAAAs, research/development and codification of advanced analytic methods should continue
- Workshops and training on developing TLAAAs with respect to LTO

Appendix II: It was agreed to delete the Column on “Safety Function” because the overall safety function was stated in the Table Title. There were several changes to specific Table items that will be documented in the next revision of WG2 Final report. WG2 members agreed to thoroughly review the Table and provide any comments in writing to Mr. Taylor by November 18.

2.2. INPUT TO IAEA ON POTENTIAL FOLLOW-ON ACTIVITIES

Working Group 2 members provide the following input to IAEA on potential follow-on SALTO activities. The input is provided by section.

2.0 Scoping of Systems Structures ad Components

Working group 2 members also recommend that more detailed requirements and acceptance criteria should be developed to support the screening and scoping process outlined in Appendix I. One way to develop more detailed guidance is to conduct a pilot study using the process outlined in Appendix I on several power plant designs and documenting the results of the pilot study for use by MS. (Most Important)

WG2 members recommend training workshops after the pilot study is completed that reflect the most recent guidance.

3.0 Aging Management Programs

Working Group 2 members recommend that MS considering LTO or currently reviewing operating plants for LTO collaborate in developing a database of known degradation mechanisms for operating plants. This database would be an essential tool for plant operators and regulators when evaluating aging management program within the framework of LTO.

Bela Feil who was substituting for Mr. Sandor Ratkai agreed to provide a brief description of the objective and benefits to plant owners and regulators by November 9.

Working Group members recommend that the IAEA facilitate workshops on developing aging and reviewing aging management programs in relation to LTO.

4.6 Non-destructive material properties testing

Working group 2 members recommend the following:

- Technical exchange meetings in the area of NDE material property measurements

5.0 Time Limited Aging Analysis

Working Group 2 members recommend the following actions to improve TLAAAs.

- Sharing international experience on material property for SSCs in the scope of LTO, this could include a database of material property measurements
- Working group 2 members recommend that IAEA facilitate development of minimum standards specific to applicable of LTO for TLAAAs.
- In order to improve the accuracy of TLAAAs, research/development and codification of advanced analytic methods should continue
- Workshops and training on developing TLAAAs with respect to LTO

2.3 ACTION ITEMS

The following action items were agreed to:

- Claude Reig, Teodora Ribarska and Vladimir Piminov agreed to revise Section 4.6 of the report by November 9, 2005.
- Mr. Taylor agreed to revise the Final WG2 report based on comments the meeting and distribute the report by November 9th, provide he receives input as agreed upon.
- WG2 members agreed to thoroughly review the Table and provide any comments in writing to Mr. Taylor by November 15.
- Bela Feil agreed to provide a brief description of the objective and benefits to plant owners and regulators by November 9.

**APPENDIX I.
PROVISIONAL AGENDA**

IAEA EBP ON SAFETY ASPECTS OF LONG TERM OPERATION OF PRESSURIZED
WATER REACTORS

Final Meeting of Working Group 2 - Materials and Mechanical Components

Agenda

Vienna, Austria

October 31 to November 2, 2005

Objective:

The objective of this meeting is to: 1) review the second draft of the Working Group 2, 2) develop a resolution for any conflicting opinions and 3) agree to a schedule to complete the final draft by November 30 in order to submit the final draft to the IAEA secretary by December 5, 2005. Please note that we will be review revision 4 of the WG2 report that was sent out on Tuesday October 25 and that we will be reviewing 12-15 pages of the draft report shall be reviewed per day. It would be very helpful if you have all your comments ready for discussion before the meeting.

Monday October 31

Morning 9:30 to 12:30

Opening Welcome	R. Havel
Review and Agree to Agenda	T. Taylor
Information on WG L/S Meeting in Seattle (30 min)	T. Taylor
<ul style="list-style-type: none">• time schedule of work 2005-2006• new table of content for WG Reports	

Review and Comment on Section 2.0	T. Taylor
<ul style="list-style-type: none">• Review of the text based on changes introduced by Seattle Meeting• Review of the tables, content, consistency• Review of recommendations• Suggestions for a CRP• Agree on Actions Items	

Review and Comment on Section 3.0	T. Taylor
<ul style="list-style-type: none">• Review of the text based on changes introduced by Seattle Meeting• Review of the tables, content, consistency• Review of recommendations• Suggestions for a CRP• Agree on Action Items	

Afternoon 14:00 to 17:00

Review and Comment in Section 4.1 – 4.3	T. Taylor
---	-----------

- Review of the text based on changes introduced by Seattle Meeting
- Review of the tables, content, consistency
- Review of recommendations
- Suggestions for a CRP
- Agree on Action Items

Tuesday November 1

Morning 9:00 to 12:30

Review and Comment on Section 4.4 to 4.7 T. Taylor

- Review of the text based on changes introduced by Seattle Meeting
- Review of the tables, content, consistency
- Review of recommendations
- Suggestions for a CRP
- Agree on Action Items

Afternoon 14:00 to 17:30

Review and Comment on Section 4.8 to 4.10 T. Taylor

- Review of the text based on changes introduced by Seattle Meeting
- Review of the tables, content, consistency
- Review of recommendations
- Suggestions for a CRP
- Agree on Action Items

Wednesday November 2

Morning 9:00 to 12:30

Review and Comment on Section 5.0 TLAAs T. Taylor

- Review of the text based on changes introduced by Seattle Meeting
- Review of the tables, content, consistency
- Review of recommendations
- Suggestions for a CRP

Afternoon 14:00 to 17:00

Agree on Action Items and Close T. Taylor

LIST OF PARTICIPANTS

BULGARIA

Ms. Teodora Ribarska
Kozloduy NPP
3321 Kozloduy
Bulgaria
Tel.: +359 973 7 2067
Fax: +359 973 8 0126
E-mail: ribarska@npp.cit.bg

Secretary

CZECH REPUBLIC

Mr. Petr Kadecka
UJV a.s.
25068 Husinec
Rez No.130
Czech Republic
Tel.: + 420 266173544
Fax: + 420 220940519
E-mail: kad@ujv.cz

Mr. Robert Krivanek
Dukovany NPP
Dukovany 269
675 50 Dukovany
Czech Republic
Phone + 420 568 815 200
Fax + 420 568 815670
Email Krivar1.edu@mail.cez.cz

FINLAND

Ms. Ritva Korhonen
Fortum Nuclear Services
Ltd. Rajatorpantie 8
01600 Myyrymaeki, Vantaa
Finland
Tel.: + 358 10 4532483
Fax: + 358 10 4533355
E-mail: Ritva.Korhonen@fortum.com

HUNGARY

Mr. Bela Feil
Paks NPP,
Hungary
Tel.: + 36-75-507-522
Cell: +36-20-514-1110
Fax: +
E-mail: feilb@npp.hu

LITHUANIA

Ms. Jelizaveta Korikova
Ignalina Nuclear Power Plant
Visaginas 4761
Lithuania
Tel.: + 370 386 24427
Fax: +

E-mail: Korikova@mail.iae.lt

RUSSIAN FEDERATION

Mr. Vladimir A. Piminov
OKB Hidropress
Ordzhonikidze street 21
142103 Podolsk
Moscow
Russian Federation
Tel.: + 7 095 502 79 18
Fax: + 7 095 502 79 20
E-mail: piminov@grpress.podolsk.ru

SLOVAK REPUBLIC

Mr. Miloslav Hrazsky
VÚJE, Trnava, a.s.
Okružna 5,
Trnava 91864
Slovak Republic
Tel.: + 421 805 605 226
Fax: + 421 805 42750
E-mail: hrazsky@vuje.sk

UKRAINE

Ms. Zoya Gubenko
NAEK "Energoatom"
Vetrova, 3
Kiev 01032
Ukraine
Tel.: +38 044 2010920
Fax: +38 044 2944292
E-mail: z.gubenko@direkcy.atom.gov.ua

Mr. Sergiy Kostenko
SNRCU
Arsenalna str. 9/11
Kiev 01011
Ukraine
Tel.: +380 44 254 3517
Cell:
Fax: +380 44 254 33 11
E-mail: kostenko@hq.snrc.gov.ua

USA

Mr Tom T. Taylor *Leader*
Pacific Northwest National Laboratory (PNNL)
2400 Stevens, Mail Stop K5-26,
Richland, WA 99352,
USA
Tel.: +1 509 375 4331
Fax: +1 509 375 6736
E-mail: tt.taylor@pnl.gov

EUROPEAN COMMISSION

Mr. Claude Rieg
EC, Directorate General JRC
Westerduinweg 3
P.O. Box 2
1755 ZG Petten
The Netherlands
Tel.: +31 224 565153
Fax: +31 224 565 637
E-mail: rieg@jrc.nl