Technical Meeting on "Strategy and techniques on predictive maintenance and condition monitoring"

Organized by the International Atomic Energy Agency
Hosted by Daya Bay Nuclear Power Operations & Management Company Limited of China Guangdong Nuclear Power Group

Daya Bay, Shenzhen City, China
November 29 – December 02, 2004

INFORMATION SHEET

1. BACKGROUND

Currently new nuclear power projects concentrate on a few areas of the world (the rapidly growing economies in Asia and in parts of Central and Eastern Europe). In the Western world, there is a wide tendency that existing nuclear power units pursue licence extension beyond the lifetime considered by the designer, i.e. life management is becoming more and more important.

Life management in a broad context includes the optimisation of operation regime, maintenance and operational life of systems, structures and components. The major lifetime related concern is the reliability of main components where material degradation with time is significant. The primary purpose of nuclear power plant (NPP) maintenance is to allow nuclear operators to use all functions necessary for safe and reliable power production by keeping these functions available. The direct goal of maintenance activities, therefore, is to ensure adequate component reliability.

Most major maintenance activities are conducted during planned outage periods. Outages are the biggest reason for unavailability of the nuclear units and a major portion of the maintenance costs, which, taking a share of 25-30 %, is the highest one among elements of plant operation and maintenance costs. The maintenance technologies can also be used to reduce the duration of planned outages and the frequency of forced outages, as well as to extend the operating period between outages.

There is now a need to optimise maintenance to improve both reliability and competitiveness of nuclear power plant operation. Life management aspect leads to
increased maintenance, inspection and surveillance regimes as nuclear power plants look at life extension. An increasing tendency can be identified in moving from the preventive (time based) maintenance concept to one dependent on plant and component conditions. In this context there is a need for using various on-line and off-line condition monitoring and diagnostics, non-destructive inspection techniques and surveillance. Component selection for condition based maintenance, parameter selection for monitoring condition, evaluation of condition monitoring results are issues influencing the effectiveness of condition-based maintenance. All these selections of components and parameters to be monitored, monitoring and diagnostics techniques to used, acceptance criteria and trending for condition evaluation, and economics aspect of predictive maintenance and condition monitoring should be incorporated into an integrated effective predictive maintenance programme, which is part of the plant’s overall maintenance optimisation program.

Furthermore, reliability centred maintenance using component reliability profile can be a step in the optimisation. Another method of assigning maintenance priorities is introducing risk informed in-service inspection of pressurised components. As the plant equipment becomes older, ageing monitoring and management should be considered; integrating long term activities such as major refurbishment or main component replacement to the plant outage strategy, and outage management play also significant role in the optimisation process.

2. PURPOSE OF THE MEETING

The purpose of the meeting is to identify the strategy and techniques on predictive maintenance and condition monitoring in order to enhance the reliability and competitiveness during NPP life cycle.

It is expected that the technical meeting will focus on the following topics:

- **Predictive maintenance planning strategy and technology**
  1) Strategic considerations about predictive maintenance
  2) Predictive maintenance as integrated part of plant life management program
  3) Methodology and procedures of implementing a predictive maintenance program
  4) Good practices on predictive maintenance and condition monitoring
  5) Performance indicators and effectiveness evaluation of predictive maintenance
  6) Predictive maintenance database and computerization
  7) Experience and lessons learnt about the initial introduction of predictive maintenance and condition monitoring

- **Condition monitoring techniques, procedure and experience**
  1) Vibration monitoring and rotating machine monitoring and diagnostics
  2) Shock pulse meter for rolling element bearings
  3) Oil analysis
  4) Wear debris analysis and ferrography
  5) Acoustic leakage monitoring
  6) Thermography
7) Leakage current measurement  
8) Winding resistance  
9) Motor current signature analysis and valve diagnostics  
10) Dissolved gas analysis for transformers  
11) Dew point measurement  
12) Pick up and drop voltages for relays  
13) Visual observation/inspection, listening and touching.  
14) Performance trending  
15) Special and advanced component and machine condition monitoring techniques

- Inspection, inspection optimisation and ageing monitoring  
  1) NDE/ISI code-prescriptive program and augmented program  
  2) Inspection qualification  
  3) Risk informed ISI  
  4) Corrosion and erosion monitoring  
  5) Thermal fatigue monitoring  
  6) Reactor pressure vessel irradiation embrittlement

- Economic aspects of condition based maintenance  
  1) Reduction of workload due to rescheduling maintenance actions  
  2) Cost/benefit analysis of integrated plant monitoring system

- Integrated plant condition monitoring & diagnostics systems  
  2) Validation of Smart Sensor Technologies for Instrument Calibration Reduction in NPPs  
  3) On-Line Data Acquisition and Signal Analysis and Interpretation

The TM will consider progress and results arising from various national and international activities. On the basis of papers presented, conclusions will be drawn and recommendations made for preparation of the strategies for managing plant maintenance, inspection and surveillance optimization so as to improve plant availability and safety.

Presentations should be aimed to provide guidance and recommendations for optimization of plant maintenance, inspection and surveillance programmes as well as to point out challenges and objectives for further investigations.

Later on in 2005, the IAEA will sponsor further activities to prepare a publication on the subject, the target users of which are utility engineers, R&D organisations, designers, and regulatory authorities involved in nuclear power plant maintenance, inspection and surveillance.

3. PARTICIPATION

The total number of participants will be restricted to 30 - 50 persons. Participants
should be officially nominated by their relevant governmental authority (Ministry of Foreign Affairs or National Atomic Energy Authority) and should send by fax or e-mail, the attached participation form before 1 October, 2004 to the Scientific Secretary, Huiping Cheng (h.cheng@iaea.org) of the Meeting.

Also, request for participation outside of the government nomination channels is welcome. These participants should send by fax or e-mail, the attached participation form before 1 October, 2004 to the Scientific Secretary, Huiping Cheng (h.cheng@iaea.org) of the Meeting.

4. VENUE AND ORGANISATION

The Technical Meeting is to be hosted by Daya Bay Nuclear Power Operations & Management Company Limited, China Guangdong Nuclear Power Group and will be held at the premises of Daya Bay Nuclear Power Operations & Management Company Limited, Daya Bay, Shenzhen City, Guangdong Province, China, P.R. on November 29 – December 02, 2004.

<table>
<thead>
<tr>
<th>Scientific Secretary</th>
<th>Local Administration Manager (Organisational and Administrative matters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Huiping Cheng</td>
<td>Ms. Zheng Luojuan</td>
</tr>
<tr>
<td>Division of Nuclear Power</td>
<td>Daya Bay Nuclear Power Operations &amp; Management Company Limited</td>
</tr>
<tr>
<td>International Atomic Energy Agency</td>
<td>China Guangdong Nuclear Power Group</td>
</tr>
<tr>
<td>Wagramer Strasse 5, P.O. Box 100</td>
<td>Daya Bay, Shenzhen City, China</td>
</tr>
<tr>
<td>1400 Vienna, Austria</td>
<td>Tel: + 86 755 8447 3135</td>
</tr>
<tr>
<td>Tel: +43 1 2600 22800</td>
<td>Fax: + 86 755 8447 3139</td>
</tr>
<tr>
<td>Fax: +43 1 2600 29598</td>
<td>E-mail: <a href="mailto:zhenglj@dnmc.com.cn">zhenglj@dnmc.com.cn</a></td>
</tr>
<tr>
<td>E-mail: <a href="mailto:h.cheng@iaea.org">h.cheng@iaea.org</a></td>
<td></td>
</tr>
</tbody>
</table>

The Chairman and Session Chairmen of the Technical Meeting will be appointed later. The recommendations from Session Chairmen will be reviewed in the final session of the TM together with reports and elaboration of any new recommendations arising from the meeting. Inquiries regarding the TM and local arrangements should be addressed to the Scientific Secretary, Huiping Cheng (h.cheng@iaea.org) of the Meeting and/or to Ms. Zheng Luojuan (zhenglj@dnmc.com.cn), the local administration manager.

5. ABSTRACTS AND PAPERS

Papers will be selected on the basis of abstracts and will be processed on receipt. Any individual requiring early confirmation of acceptance of their presentation is therefore encouraged to submit his/her abstract as soon as possible. The abstract should be in A4 page not exceeding 500 words and should be sent electronically to the Scientific Secretary, Mr. Huiping Cheng (E-mail: h.cheng@iaea.org) not later than 1 October 2004. Authors will be notified upon the acceptance by 15 October 2004.
Those authors whose papers are accepted should submit the original of their full-length papers to Mr. Huiping Cheng before 15 November 2004. The abstract should be included on the first page of the paper.

The Manuscript should be typed, single spaced on an A4 format or 8.5 by 11 in. paper in Times New Roman 10 or 12 point and should include original illustrations and black and white glossy prints of all photographs. A copy of all papers received by 15 November 2004 will be distributed to participants at the meeting. For “late” papers, presenters should bring 50 copies for distribution at the meeting.

The paper should be shorter than 12 typed pages (including Figures). The author’s name(s) should be given on the first page of the paper as follows:

<table>
<thead>
<tr>
<th>TITLE OF PAPER</th>
</tr>
</thead>
<tbody>
<tr>
<td>By</td>
</tr>
<tr>
<td>Mr San Zheng*, George Young**, Willy Spring***</td>
</tr>
<tr>
<td>* Position and Address</td>
</tr>
<tr>
<td>** Position and Address</td>
</tr>
<tr>
<td>***Position and Address</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ABSTRACT</th>
</tr>
</thead>
</table>
Based on abstract provided previously, but to include major conclusions.

<table>
<thead>
<tr>
<th>KEY WORDS</th>
</tr>
</thead>
</table>
Include a list of keywords at bottom of first Page

In addition to the Master (paper) copy, an electronic version of the paper is necessary to ensure quality and timely issuance of the proceedings to be prepared and distributed in electronic form (CD-ROM). It is highly desirable to use an internationally used software programme, preferably in MS Word format. Further details of format and layout of the Manuscript can be obtained from Mr. Huiping Cheng.

The working language of the meeting will be English.

An overhead projector and a device for showing computer-based presentations will be provided in the meeting room. Computerised presentations may be provided on CD-ROM or 3½” floppy disc in Microsoft Power Point Format or the author’s laptop computer may be used. If there are any special needs, please contact Ms. Zheng Luojuan, the local administration manager (address above) at an early stage. Time for the presentation of the papers will be limited to 20 minutes in order to have sufficient time for discussion.

6. VISAS

Participants who require a VISA to enter China should submit the necessary application to the nearest diplomatic or consular representative of China as soon as possible. The necessary VISA support is to be provided by Ms. Zheng Luojuan, the local administration manager. The form “Personal Data” with the cover page with photo (1st page) of passport are to be sent directly to Ms. Zheng Luojuan, the local administration manager not later than 1 October, 2004. For accompanying persons a separate “Personal Data” form with the cover page with photo (1st page) of passport...
has to be sent.

7. **ACCOMMODATION**

Participants will be accommodated in a hotel at Daya Bay. Ms. Zheng Luojuan, the local administration manager, will provide assistance to the hotel reservation. The participants should send their request for the accommodation directly to her not later than 31 October 2004.

8. **EXPENDITURES**

The organizational cost of the meeting is borne by the host. Travel and all subsistence expenses are to be covered by the participants.

9. **DEADLINES**

1) Nomination of participants by governments: 1 October 2004
2) Abstract submission: 1 October 2004
3) Personal data for visa assistance: 1 October 2004
4) Abstract/participation Acceptance: 15 October 2004
5) Accommodation request: 31 October 2004
6) Full paper submission: 15 November 2004

10. **LOCAL TRANSPORTATION/TOURISM INFORMATION**

To be provided later (by email).

11. **SCHEDULE/AGENDA OF TECHNICAL MEETING**

To be provided later (by email).
PARTICIPATION FORM

IAEA TECHNICAL MEETING
on
"Strategy and techniques on predictive maintenance and condition monitoring"

Daya Bay, China
November 29 – December 02, 004

Please, complete and send before 1 October 2004 to the competent official authority (Ministry of Foreign Affairs or National Atomic Energy Authority, Organization) for transmission to:

Mr. Huiping Cheng
International Atomic Energy Agency
Wagramer Strasse 5, P.O. Box 100
Vienna International Centre, 1400 Vienna, Austria
Fax: +43 1 2600 29598
E-mail: h.cheng@iaea.org

Participants should register as soon as possible upon the receipt of this Information Sheet.

<table>
<thead>
<tr>
<th>Surname:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Given Names:</td>
</tr>
<tr>
<td>Dr./Mr./Ms:</td>
</tr>
<tr>
<td>Title (position):</td>
</tr>
<tr>
<td>Institution/Organization/Company:</td>
</tr>
<tr>
<td>Full address:</td>
</tr>
<tr>
<td>Tel:</td>
</tr>
<tr>
<td>Fax:</td>
</tr>
<tr>
<td>Telex:</td>
</tr>
<tr>
<td>E-mail:</td>
</tr>
<tr>
<td>I intend to present a paper:</td>
</tr>
<tr>
<td>No / Yes, with the following title:</td>
</tr>
<tr>
<td>And enclose a 300 word extended summary.</td>
</tr>
<tr>
<td>Date:</td>
</tr>
<tr>
<td>Signature:</td>
</tr>
</tbody>
</table>
ACCOMODATION FORM

IAEA Technical Meeting
on
"Strategy and techniques on predictive maintenance and condition monitoring"

Daya Bay, China
November 29 – December 02, December 2004

Please, complete and return directly to Ms. Zheng Luojuan, the Local Administration Manager before 31 October 2004.

Ms. Zheng Luojuan
Daya Bay Nuclear Power Operations & Management Company Limited
China Guangdong Nuclear Power Group
Daya Bay, Shenzhen City, China
Tel: + 86 755 8447 3135
Fax: + 86 755 8447 3139
E-mail: zhenglj@dnmc.com.cn

First name ____________ Family name ______________ Title__

Contact address________________________________________
______________________________________________________
Country _________          Phone____________ FAX ___________
E-mail _______________________________________________

Date of arrival to Daya Bay ____________

Hotel in Daya Bay         Yes__________ No_________

Date of departure from Daya Bay___________

Accompanying person        Yes__________ No_________

Hotel:

Single room(s) _____ Double room(s) _____ Twin room(s) ______

Smoking _____ No smoking _____ (please tick as required)
PERSONAL DATA

Please, complete and return directly to Ms. Zheng Luojuan, the Local Administrat Manager, before 1 October 2004.

Ms. Zheng Luojuan
Daya Bay Nuclear Power Operations & Management Company Limited
China Guangdong Nuclear Power Group
Daya Bay, Shenzhen City, China
Tel: + 86 755 8447 3135
Fax: + 86 755 8447 3139
E-mail: zhenglj@dnmc.com.cn

1. NAME:
2. SURNAME:
3. DATE of BIRTH: (date-month-year)
4. NATIONALITY: SEX:
5. PASSPORT NUMBER: EXPIRY DATE:
6. ARRIVAL DATE:
7. DEPARTURE DATE:
8. CITY WHERE YOU’LL GET THE CHINESE VISA:
9. OFFICIAL PROFESSION:
10. NAME OF AFFILIATION/ORGANIZATION:
11. ADDRESS OF AFFILIATION/ORGANIZATION:
   Zip code Country City
   Street:
   Telephone: Fax: E-mail:
12. COPY of Passport Information: