Operating Reactor by age (as of June. 2007)

Total: 439  + 20 years: 327  - 20 years: 112

Note: Age of a reactor is determined by its first grid correction.
<table>
<thead>
<tr>
<th>IAEA Activities related to PLiM-LTO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Development of related IAEA Safety Standards &amp; Technical guidelines</strong></td>
</tr>
<tr>
<td>• Reactor Pressure Vessel Integrity</td>
</tr>
<tr>
<td>• Ageing Management</td>
</tr>
<tr>
<td>• Plant life management</td>
</tr>
<tr>
<td>• Competitiveness of Operation</td>
</tr>
</tbody>
</table>

| **Direct Service through Technical cooperation projects and Review service to assist Member States** |
| • Technical cooperation projects |
| • Training course |
| • Workshop |
| • Expert Mission |
| • Equipment procurement |
| • Engineering service |

| **Peer review service** |
| • Ageing management review |
| • Safety long term operation |
IAEA Safety Standards and Guidance Documents on Plant Life Management and AM Programme

Safety Requirement
- Safety Guide on AM
- Safety of NPP Design NS R-1 (to be revised)
- Safety Guide on PSR (to be revised)
- Safety Guide on MSI
- Safety Guide on Personal Qualification

Safety Guide
- DS 382 under developing
- Safety Guide on AM
- Safety Guide on PSR (to be revised)
- Safety Guide on MSI
- Safety Guide on Personal Qualification

Tech. Guidelines
- Programmatic Guidelines (5)
- Component Specific Guidelines (13)
- AMP Review guideline (1)
- RPV and PLiM (8)
- Human Ageing Guideline (10)
- Maintenance I&C (10)

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Tech. Guidelines
- Programmatic Guidelines (5)
- Component Specific Guidelines (13)
- AMP Review guideline (1)
- RPV and PLiM (8)
- Human Ageing Guideline (10)
- Maintenance I&C (10)

Keep updating
- NENP
- NSNI
- Keep updating
Structural, system and component (SSC) integrity is at the core of NPP management.
RPV integrity under irradiation damage

- Ni/Ni-Mn effect
- Cu/P effect with/without Ni
- Irradiation damage challenge
- Dose rate effects
- Decrease of USE
- Matrix damage
- Thermal/Irradiation (C-Mn Effect, Hardening vs non-hardening, etc.)
- Other V, Mo, Cr, stress cooling rate, etc.

Testing
Model
Core weld
CRP- RPV Structural Integrity since 1975

CRP 5 : Surveillance Programme Results Application to Reactor Pressure Vessel Integrity Assessment (2003)


CRP 8 : Master Curve Approach to monitor the Fracture Toughness of RPV in Npps (2004 – 2007)


Over 100 organizations and institutes
TECDOC -1435, 1441 and 1442, TRS- 429
Reactor Pressure Vessel Integrity

TECDOC 1435 : Application of Surveillance programme results to RPV

TECDOC 1441 : Guidelines for Prediction of Radiation Embrittlement of Operating WWER-440 RPVs

TECDOC 1442 : Effects of Ni on Irradiation Embrittlement of RPV Steels

TRS 429 : Guidelines for application of the Master Curve to RPV integrity
Draft Safety Guide on Ageing Management

- **Objective**
  - To provide a set of guidelines and recommendations for managing ageing of Systems Structures and Components (SSCs) important to safety in nuclear power plants.

- **Scope**
  - SSCs in NPPs.
  - Mainly focused on physical ageing but also includes management of obsolescence.

- Will be published in 2008
Recent material degradation and related managerial issues

- August 2004, Mihaman # 3 NPP
- 15 - 18 February 2005, VIC

- Mihama #3: there was the omission of the ruptured portion in the check list from the beginning and the omission had never been corrected until the accident took place.
Guidelines & Experience on Heavy Components Replacement in LWR / HWR

- Replacement of
  - Steam generator
  - PZR for PWR,
  - RVH for PWR,
  - RPVI for PWR
  - Reactor Internal Components for BWR
  - RCS Piping
  - Feeder piping and pressure tube for PHWR

- Safety and Licensing regulatory issues
- Operation management
PLiM Approaches for Long Term Operation

Table of Contents
1. Introduction
2. Current Trend for PLiM
3. General Approach to PLiM
4. Issues of PLIM (Tec. Reg, Eco.)
5. Relation between Maintenance & PLiM
6. Research requir. for PLiM
7. Cons. and Recomms

- Country Reports:
  - For LWR: Belgium, Bulgaria, Czech, Hungary, Japan, Germany, France, Korea, Russia, Slovakia, Spain, Switzerland, USA
  - For PHWR: Argentina, Canada, India, Korea, Pakistan, Romania
I&C Ageing Management Guidelines

Management of life cycle and ageing at nuclear power plants: Improved I&C maintenance

Report prepared within the framework of the Technical Working Group on Nuclear Power Plant Control and Instrumentation

IAEA
International Atomic Energy Agency

August 2004
PLiM- SALTO Review Services

Support to establish PLiM Programme under TC project

- Argentina : PLiM programme for Embalse NPP
- China : Ageing management of Critical Components
- Hungary : License Renewal of Paks Nuclear Power Plant Operation
- Mexico : Life Management programme for Laguna Verde NPPs
- Ukraine : Action Plans for Nuclear Power Plant Lifetime Management
- Pakistan : Development of Capabilities in Automatic UT and Material Corrosion testing for Assessment of Structural Integrity

Review missions (SALTO peer review services) implemented and scheduled:

- South Ukraine NPP (Mar. 2007, Ukraine)
- Kori 1 NPP – LTO Peer review (Republic of Korea – July 2007)
- Dukovany NPP – LTO Peer review (Czech republic 3Q 2008)
- Paks NPP SALTO Peer review (Hungary – Sept. 2008)
Workshop. Mission and Equipment supply
SALTO Peer Review Services

- Scope of SALTO Peer Review Services:
  - LTO Feasibility;
  - Scoping and Screening Process;
  - Assessment and Management of SSCs for Ageing Degradation for LTO;
  - Revalidation of Safety Analyses

- Important engineering activities for operating NPPs:
  - Configuration management;
  - Design basis reconstitution;
  - FSAR update, etc.

- Review of PSR activities. (Future module)

IAEA
SALTO Peer Review Services

SAFE
LONG TERM OPERATION
OF NUCLEAR POWER PLANTS
SYSTEMS, STRUCTURES AND COMPONENTS
IMPORTANT TO SAFETY

ALTO peer review guidelines

Reference document for the
IAEA engineering safety service on
peer review of Long Term Operation and
Aging Management of NPPs

IAEA
July 2007
Knowledge on PLiM for LTO

MS Activities related to PLiM for LTO

PLiM for LTO
(One project (NE/NS)

Information exchange forum

CRP R&D results

NE Docu, series

Guidance

Meetings

Aging mech. index

Service Review

Education & Training

Technical input from other database
- OECD NEA
- EC JRC
- Others

Member States Experience & Practices

Feed Back from MS

Support
Catalyse
Build

IAEA

PLiM : Plant Life Management