IAEA activities on Plant Life Management (PLIM), Maintenance and Outage optimization

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Age of operating reactors

As of End of Aug. 2014

Total Number of Reactors: 437

Number of Reactors

Years

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45

Number of Reactors

0 5 10 15 20 25 30 35
PLiM for LTO → Gen II⁺ and Gen III⁺
Tech Works – Safety and Technology

- Development of Safety Standards, and Guidelines
- Tech. Cooperation Activities (Workshop, Training Course)
- Peer Review Service
Work Scope for Operating and New Comers

**International Organizations**
- EC-JRC
- OECD-NEA
- WANO
- National Organizations (INPO, EPRI)

**Engineering Support**
- Operating NPPs and Expanding Programme

**Integrated Cross-cutting Activities**

**Materials Aging & Degradation**
- Reactor Pressure Vessel material
- Ageing Management
- Non-Metallic (Concrete)
- Cabling aging
- Buried Piping
- Mitigation Technologies

**Maintenance and Safety Margin**
- Maintenance
- Outage management
- NDE/ISI
- Power uprates
- Severe Accident Management

**I&C Systems Technologies**
- Centralized Online Monitoring and Information Integration
- New I&C and HSI
- Post Accident Monitoring System
- Cyber Security

**Information Processing & Efficiency Improvement**
- Power Rector Inf. System(PRIS)
- Country Nuclear Power Profile
- Performance Alternative cooling

**Support New Comers**
- Pre-construction & management
- Feasibility Study
- TSO role and responsibilities
- Design Review
- Project management
- Human Resource Development
- Procurement
- Grid
- National involvement

**Technical Cooperation projects**
( Int –Reg, Reg, and National)
On going Activities for Operating NPPs

- PLiM Models for LTO
- VVER Water chemical control
- Foreign material exclusion
- AM programme of non-metallic components
- Buried piping
- AM Handbook
- Dissimilar metal welding
- Fatigue monitoring & analysis
- Maintenance optimization
- Impact of Fukushima LLs on AM, PLIM for LTO
- Fire protection programme

- Flexible Operation
- Accident monitoring systems for NPPs
- Application of FPGAs in NPP I&C systems
- Engineering Review of I&C Systems
- Robustness of digital I&C systems in NPPs against malicious acts
Activities supporting NPP maintenance

- Standards, safety guides, technical documents
- Databases and information systems
- Conferences, technical meetings, workshops, training courses, scientific visits
- Technical missions
- Studies, research projects

Reference: IAEA-PRIS
Related IAEA documents

- NES NP-T-3.14, Advanced Surveillance, Diagnostic and Prognostic Techniques in Monitoring SS&C in NPPs, 2013
- NES NP-T-3.6, Assessing and Managing Cable Ageing in Nuclear Power Plants, 2012
- NES NP-T-3.13, Stress Corrosion Cracking in Light Water Reactors, 2011
- NES NP-T-3.1, Risk Informed In-service Inspection of Piping Systems of NPPs, 2010
- SRS-62, Proactive Management of Ageing for NPPs; 2009
- NES NP-T-1.2, On-line Monitoring for Improving Performance of NPPs 2008
- TECDOC-1590, Application of RCM to Optimize Operation and Maintenance in NPPs, 2008
- TRS-448, Plant Life Management for Long Term Operation of Light Water Reactors, 2007
- TECDOC-1509, Integrated Approach to Optimize Operation and Maintenance Costs for Operating NPPs; 2006
- TECDOC-1490, Indicators for Management of Planned Outages in NPPs, 2006
- STI/PUB/1260, Material Degradation and Related Managerial Issues of NPPs, 2006
- SRS-42, Safety Culture in the Maintenance of NPPs; 2005
- TECDOC-1402, Management of Life Cycle and Ageing at NPPs: Improved I&C Maintenance; 2004
- TECDOC-1400, Improvement of In-service Inspection in Nuclear Power Plants, 2004
- TECDOC-1383, Guidance for Optimizing NPP Maintenance Programmes, 2004
- TECDOC-1315, NPP Outage Optimisation Strategy, 2002
- SS NS-G-2.6, Maintenance, Surveillance and In-Service Inspection in NPPs, Safety Guide, 2002
Guidance for Optimizing Nuclear Power Plant Maintenance Programmes

A systematic evaluation approach to establishing what maintenance tasks are to be performed on which systems, structures or components, and at what periodicity, can lead to optimization of the use of resources.

This publication deals with the managerial and engineering aspects of NPP maintenance, its optimization process with special regard to the importance of condition monitoring in maintenance strategies and the contribution of maintenance to managing the lifetime of operating NPPs.

Appendices to this publication consist of selected papers on maintenance optimization.
Revision of IAEA TECDOC-1383 on “Guidelines for optimizing NPP maintenance programmes”

- The objective of this project is to increase Member States capabilities in optimizing maintenance programmes and utilization of best practices in order to improve the overall performance and competitiveness of NPPs.
- Experts from: Czech Rep, Finland, France, Germany, Hungary, Korea; Sweden, Switzerland, USA
- Draft of the new document is in process

Related meetings:
- Consultancy meeting, Vienna, 19-21 November 2013
- Consultancy meeting, Vienna, 3-5 June 2014
- Technical meeting, London, 8–10 September 2014
- Consultancy meeting, Vienna, 18-20 November 2014
Outage optimization activities

- TecDod-1315, Nuclear Power Plant Outage Optimization Strategy, Published 2002
- Revision and updating begins by first meeting
  - 2 - 5 Dec. 2014 in Vienna
- Planned technical meeting in third quarter 2015
- Final document will be published in 2016
Purpose of revision

- Promote improvements in outage performance objectives
  - Optimizing nuclear safety of the plant while shut down through careful planning and operation that
    - Maximize defence-in-depth and clearly identify and minimize outage windows of elevated risk
  - Improving equipment reliability and availability through the appropriate mix of CM, PM, PdM and CBM
  - Improving the effectiveness of outages in achieving established utility goals, implementing long-term plans, carrying out well-coordinated work controls, and coordinating basic outage support functions, such as engineering and parts availability
Update focuses ->, Outage management

- Long-range planning
- Outage planning and scheduling
- Conduct of critical schedule review
- Utilization of operating experience
- Modification preparation
- Interface with regulatory body
- Continuous improvement of outage with lessons learnt from previous outages
- Development of the outage schedule and risk profile
Update focuses ->,
Shut down operations

• Preparing for shutdown operation to ensure residual heat removal
• Preparations for refuel floor activities/fuel handling
• Readiness to implement contingencies
• Just-in-time training plans
Update focuses -> maintenance and project management

- Implementation plans for major projects
- Work package preparation
- Modification preparation
- Management plans for supplemental personnel
- Detailed scheduling
- Material management
- Status of work package preparation
- Post maintenance testing
Related IAEA publications

- Advances In Safety Related Maintenance, TecDoc-1138
- Assuring the Competence of Nuclear Power Plant Contractor Personnel, TecDoc-1232, 2001
- Risk Management A Tool for Improving Nuclear Power Plant Performance, TecDoc-1209, 2001
- Maintenance, Surveillance and In-service Inspection In nuclear Power Plants, Safety Guide NS-G-2.7, 2002
- Improvement of In-Service Inspection in NPPs, TecDoc-1400, 2004
- Management Strategies for NPP Outages, TRS 449, 2006
- Indicators for Management of Planned Outages in NPPs TecDoc-1490, 2006
- Safety of NPPs: Commissioning and Operation, Safety Requirements SSR2/2, 2011

• QUESTIONS OR COMMENTS