Challenges and Needs for Long Term Operation of Nuclear Power Plants

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Long Term Operation of Nuclear Power Plants

Nuclear Power Plants

- 288 in operation for more than 30 years
- 87 in operation for more than 40 years
- 57 under construction

Long Term Operation

- Operation beyond an established time frame defined by the licence term, the original plant design, relevant standards, or national regulations

Programme

- Cumulative effects and implications of ageing (ageing mechanisms and ageing management programmes)
- Safety modifications (repairs, replacements and upgrades)
- Technical developments
- Operating experience
- Site characteristics

Licensing documentation

- Valid through the entire period

Source: http://www.iaea.org/pris
Safety Challenges for Long Term Operation

National energy strategies and policies
• Direction on the future of nuclear energy
• Nuclear energy as viable option

National regulatory frameworks
• Fitness for service of Structures, Systems and Components
• Safe operation for extended period of operation
• Effectiveness of safety functions
• Consideration of safety improvements

Safety of operation
• Understanding of the plant condition
  ✓ Physical aging of Systems, Structures and Components
• Technological and conceptual obsolescence
  ✓ Operating experience and new standards
  ✓ Implementation of safety upgrades
  ✓ Quality of equipment, suppliers and contractors
• Qualified workforce
IAEA Activities Supporting Long Term Operation

Development of IAEA Safety Standards

- Requirements for commissioning and operation
  - Requirement 12: Periodic Safety Review (PSR)
  - Requirement 14: Ageing Management (AM)
  - Requirement 16: Programme for Long Term Operation (LTO)
- Guidance on PSR, Ageing Management and LTO

Capacity building

- International Generic Ageing Lessons Learned Programme
- Ageing management and LTO workshops
- Coordinated research projects

Review services

- Operational Safety Review (OSART) – LTO module
- Safety Aspect of Long Term Operation (SALTO)
- Site and External Events Design Review (SEED)
- Technical Review Services (design assessment)
IAEA Safety Standards for Long Term Operation

Ageing

Physical ageing

Non-physical ageing (obsolescence)

Obsolescence of technology

Obsolescence of codes, standards and regulations

Obsolescence of knowledge

Guidance on AM and LTO

Guidance on PSR

Obsolescence of technology

Obsolescence of codes, standards and regulations

Obsolescence of knowledge
SALTO Peer Review: Objective

Objective assessment of the status of preparation for LTO

- Review of alignment with IAEA Standards
- Recommendations and suggestions for full implementation of IAEA Standards
- Opportunity to share experience and practices with international experts
- Advice on licensing processes and procedures
- Openness and transparency
  - Public awareness and acceptance

Focus on physical ageing and technological obsolescence

31 SALTO missions in 18 NPPs
SALTO Peer Review: Observations

Programmes for Long Term Operation are generally based on Periodic Safety Reviews

- Safety assessment with due consideration of ageing
- Demonstration of validity of (updated) licensing basis
- Review of adequacy of the arrangements to maintain plant safety
- Implementation of improvements to resolve the safety issues identified

Opportunities for further improvements

- Clarity of national regulations for LTO
- Policies and organizational arrangements for LTO
- Completeness of ageing management review
- Timely implementation of LTO programmes
- Consideration of reasonably practicable safety improvements
Reasonably Practicable Safety Improvements

Vienna Declaration on Nuclear Safety

Objective
Prevent accidents with radiological consequences and, should an accident occur, mitigate possible releases of radionuclides

Review Process
• Comprehensive and systematic safety assessments are to be carried out periodically and regularly for existing installations throughout their lifetime in order to identify safety improvements that are oriented to meet the above objective. Reasonably practicable or achievable safety improvements are to be implemented in a timely manner
• National requirements and regulations for addressing this objective throughout the lifetime of nuclear power plants are to take into account the relevant IAEA Safety Standards
Periodic Safety Review

Objective
Systematic and comprehensive safety assessments of the plant performed by the operating organization throughout the plant’s operating lifetime with due account taken of operating experience and significant new safety related information from all relevant sources.

Scope
Consequences of the cumulative effects
• plant ageing and plant modifications
• equipment requalification
• operating experience
• current standards and technical developments
• organizational and management issues
• siting aspects

Main Benefits
Determination of reasonable and practical modifications that should be made to enhance the safety of the plant to a level approaching that of modern plants, and to allow for long term operation
Summary

Considerations for safe Long Term Operation

- Extent to which the plant conforms to modern standards and practices
- Extent to which the (updated) licensing basis will remain valid
- Adequacy of arrangements to maintain plant safety
- Improvements to be implemented to resolve safety issues, including reasonably practicable modifications

Programmes for Long Term Operation

- Demonstrate adequate arrangements to maintain plant safety for extended period of operation are being implemented
- Opportunity for determination of reasonable and practical modifications
  - Enhance the safety of the plant to a level approaching that of modern plants
  - Prevent accidents with radiological consequences and, should an accident occur, mitigate possible releases of radionuclides
- Reasonably practicable safety improvements are to be assessed and implemented in a timely manner