AGEING MANAGEMENT ASSESSMENT

Module 9

Session 9

Resource document: AMAT Guidelines, Reference document for Ageing Management Assessment Teams, IAEA Services Series No. 4, (1999)

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Presentation

1. AM assessment
   - Objective
   - Scope
   - Types of review
2. Programmatic review
3. Problem/issue specific review

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1. AM assessment

General objective of AM assessment:

To strengthen and enhance the effectiveness of NPP ageing management programmes (AMPs)

- **AMAT Guidelines is a reference document for IAEA Ageing Management Assessment Teams (AMATs)**
- **Purpose of AMATs is to provide advice and assistance to utilities or individual NPPs on improving the effectiveness of their AMPs**

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1. AM assessment

Scope of AM assessment

- Programmatic review of a utility or NPP ageing management programme

- Problem specific review - review focused on a specific age related problem or issue

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1. AM assessment
Types of review

- Self-assessment
- Peer review
- Comprehensive review

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1. AM assessment
Self-assessment

- Review carried out by an NPP organization to optimize its AMP within the framework of continuous improvement

- AMAT Guidelines provide relevant guidance

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1. AM assessment

Peer review

- Determination of weather the existing AMP meets the generally accepted practices and identification of areas for future improvement

- For example, an AMAT review organized by the IAEA

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1. AM assessment
Comprehensive review

- Determination of weather the ageing of SSCs important to safety is being effectively managed, the required integrity and functional capability of SSCs are being maintained, and an adequate AMPs are in place for continued plant operation

- For example, carried out as part of a Periodic Safety Review or NPP life extension/ licence renewal

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2. Programmatic review
Areas of Review

- **AMP strategy**

  Account of regulatory requirements and international guidance; policy statement; scope definition

- **AMP organization**

  Organization and programme description; adequacy of resources

- **AMP activities**

  SSC screening method; procedures for operation, surveillance, maintenance, equipment qualifiction, data collection and record keeping, spare parts programme.

- **AMP results**

  physical condition of SSCs - walkdown; EQ established and maintained; performance indictors

- **AMP monitoring**

  mechanism for continuous improvement

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2. Programmatic review
AMP strategy

- Account of regulatory policy and requirements
- Account of international guidance and good practice
- AMP policy statement
- AMP scope definition

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2. Programmatic review
AMP organization

- AMP organization; coordination of relevant programmes/activities (programme description)
- Adequacy of resources:
  - **Human**
  - **Financial**
  - **Tools and equipment**
  - **External**
- Provisions for understanding of SSC ageing – feedback of operating experience and research
- Formal communication links between NPP operations, maintenance, engineering, designer and manufacturers, utility management, and external TSOs

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2. Programmatic review
AMP activities

- SSC screening method
- Operating procedures to control service conditions/rate of degradation of SSCs
- Surveillance programme
- Maintenance programme
- Equipment qualification programme
- Data collection and record keeping system
- Spare parts programme.

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2. Programmatic review
AMP results

- Actual physical condition of SSCs – documented and supported by a walkdown
  - **Records of ambient service conditions**
  - **Records of system parameters**
- EQ established and maintained
- Performance indictors satisfactory

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2. Programmatic review
AMP monitoring

- Self-assessment programme; records of self-assessments performed
- Results of peer reviews
- Comprehensive reviews and PSR
- Continuous improvement process:
  - **commitment of NPP staff**
  - **completion of corrective actions resulting from the above reviews**

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2. Programmatic review
NPP walkdown

- SSCs properly identified and located
- SSCs in good working order
  - **No leaks**
  - **Properly protected**
  - **Good supports**
  - **Good electrical connections**
  - **Free of dirt/dust/contamination**
  - **No cracks, colour change, corrosion, wear**
- Level of vibration acceptable
- Spare parts well stored

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3. Problem/issue specific review

Focused on:

- **age related problems specific to SSCs, (pumps, valves, steam generators, cables, containment structures, etc.)**
- **specific ageing mechanisms, (radiation embrittlement, corrosion, fatigue, wear, etc.)**

3. Problem/issue specific review

Example

- Generic evaluation of the Flow-Accelerated Corrosion (FAC) Program using USNRC ten elements of an effective aging management program.

- Problem: wall-thinning in feedwater, condensate, heater drains and extraction steam systems

3. Problem/issue specific review

Ten elements of an effective AMP

- Scope
- Preventive Actions
- Parameters Monitored or Inspected
- Detection of Aging Effects
- Monitoring and Trending
- Acceptance Criteria
- Corrective Actions
- Confirmation Process
- Administrative Controls
- Operating Experience

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3. Problem/issue specific review

Flow-Accelerated Corrosion Program

- Overview

- The program includes performing:
  - **analysis to determine critical locations**
  - **limited baseline inspections to determine the extent of thinning at these locations**
  - **follow-up inspections to confirm the predictions**
  - **repairing or replacing components, as appropriate**

3. Problem/issue specific review

Flow-Accelerated Corrosion Program

- Scope

- Carbon steel lines important to safety containing high-energy fluids

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3. Problem/issue specific review

Flow-Accelerated Corrosion Program

- Preventive Actions (for reducing FAC)

- Monitoring of water chemistry to control pH and dissolved oxygen content
- Use of appropriate piping material
- Appropriate piping geometry
- Appropriate hydrodynamic conditions

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3. Problem/issue specific review

Flow-Accelerated Corrosion Program

- *Parameters Monitored/Inspected*

- **Wall thickness**

3. Problem/issue specific review

Flow-Accelerated Corrosion Program

- *Detection of Aging Effects*

- The inspection program consists of identification of susceptible locations as indicated by operating conditions or special considerations. (Software, e.g. CHECWORKS is used)

- Ultrasonic and radiographic testing is used to detect wall thinning.

- The extent and schedule of the inspections should ensure detection of wall thinning before the loss of intended function.

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3. Problem/issue specific review

Flow-Accelerated Corrosion Program

- *Monitoring and Trending (1)*

- CHECWORKS or a similar predictive software code is used to predict component degradation in the systems conducive to FAC, as indicated by specific plant data, including material, hydrodynamic, and operating conditions.
- CHECWORKS is acceptable because it provides a bounding analysis for FAC.
- CHECWORKS was developed and benchmarked by using data obtained from many plants.

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3. Problem/issue specific review

Flow-Accelerated Corrosion Program
- *Monitoring and Trending (2)*

- The inspection schedule developed by the licensee on the basis of the results of such a predictive code provides reasonable assurance that structural integrity will be maintained between inspections.

- If degradation is detected such that the wall thickness is less than the minimum predicted thickness, additional examinations are performed in adjacent areas to bound the thinning.

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3. Problem/issue specific review

Flow-Accelerated Corrosion Program

- Acceptance Criteria

- Inspection results are used as input to a predictive computer code, such as CHECWORKS, to calculate the number of refueling or operating cycles remaining before the component reaches the minimum allowable wall thickness.

- If calculations indicate that an area will reach the minimum allowed thickness before the next scheduled outage, the component is to be repaired, replaced, or reevaluated.

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3. Problem/issue specific review

Flow-Accelerated Corrosion Program

- Corrective Actions

- Prior to service, reevaluate, repair, or replace components for which the acceptance criteria are not satisfied.

- Longer term corrective actions could consist of adjustment of operating parameters or selection of materials resistant to FAC.

3. Problem/issue specific review

Flow-Accelerated Corrosion Program

- Confirmation Process and Administrative Controls

- NPP quality assurance (QA) procedures, review and approval processes, and administrative controls to be implemented in accordance with the regulatory requirements

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3. Problem/issue specific review

Flow-Accelerated Corrosion Program

- Operating Experience

- Wall-thinning problems have occurred in:
  - **single-phase systems feedwater and condensate systems**
  - **two-phase piping in extraction steam lines**
  - **moisture separation reheater and feedwater heater drains**

- Operating experience shows that the above outlined program, when properly implemented, is effective in managing FAC in high-energy carbon steel piping and components.

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Conclusion

- Both programmatic and problem-specific AM reviews are useful instruments for strengthening and enhancing the effectiveness of NPP ageing management programmes

- AMAT Guidelines provide instructions for implementing the programmatic AM reviews

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