Plant Life Management experience at Tarapur Atomic Power Station (INDIA)

By

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NPCIL Profile

- NPCIL is responsible for Design, Construction, Commissioning, Operation, Maintenance, Life management, and Decommissioning of Indian NPPs.
- 17 reactors in operation. Installed Capacity 4120 Mwe (3% share of energy)
- Oldest: TAPS-1,2 (Oct 1969)
- Latest: KAIGA-3 (May 2007)
- 6 reactors under construction (PHWR, LWR, FBR) Total 3380 Mwe

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VINAY THATTEY (Sr. Engineer)
Salient Features OF TAPS 1 & 2

- IGE turnkey project
- Construction started: MAY 1964
- Commercial operation: NOV 1969
- 38TH Year of operation.
- Rating : SINGLE CYCLE – 160 MW
  DUAL CYCLE – 210 MW
- Energy produced > 70 BU
- Present tariff: 93 paise /unit (< 2 cents)
Review of Life Management aspects for continued operation of TAPS

- Periodic Safety Review of TAPS initiated in 2000 as part of License Extension. This included:
  - Probabilistic Safety Assessment. (Level-1)
  - Review of Operational Performance.
  - Review of Ageing Management and residual life of SSCs.
  - Review of Design Basis of plant systems and Safety analysis, vis-à-vis the current requirements.
  - Seismic Re-evaluation.
Review
Requirement & Objectives

Review required because of:
- Changes in applicable design codes
- Availability of better analytical tools
- Better understanding of degradation mechanisms
- Comparing with current standards

Objectives of review:
- To identify and prioritize safety issues
- To identify and implement corrective measures where necessary
Review of Life Management aspects for continued operation of TAPS

- Review Of Life Management
  - Present status of the SSCs
  - Identified modes of degradation
  - Monitoring methods

- Assessment of available margins taking account of
  - Results of revised Safety Analysis
  - Comparison of the current Codal with the earlier requirements followed for TAPS units
  - Various upgradations
Review Of Ageing

- Identification of key systems, structures and components (SSCs).

- Classified as
  - Major critical components
  - Important systems
  - Other critical components.

- Components further classified as
  - Not replaceable
  - Replaceable with re-engineering
  - Replaceable on routine basis.

- For each component mode of degradation identified, ageing assessment done and action plan indicated.
PLIM in TAPS-1,2

- Information pertaining to the sscs is systematically documented and analysed
  - Present status of health
  - Known degradation mechanisms
  - Adequacy of present monitoring methods and practices
- Action plans evolved
  - For ageing studies
  - Residual life assessment
  - Need for development activities for inspection / health assessment of presently un-inspectable areas
  - Equipment replacement.
PLIM Objective

- Improvement of safety performance of TAPS-1,2
- Maximising operating life without compromising safety
- Harmonizing various good practices
- Address various aspects to be considered during different stages of plant, starting from the conceptual design as well as the organizational aspects.

- Reference Documents:
- AERB safety guide on Life Management of NPPs. AERB/NPP-SG-O-14
Selection of SSC

- Screening & Categorising of SSC (Replaceable/Non-replaceable)
- Prioritization of Safety Issues
- Condition Monitoring & ISI
- Measures to Mitigate Ageing
- License Renewal

**Safety Goal:** "Plant reference safety level is expected to be maintained during extended period of operation as per the original design"
Safety State Of Components And Safety Margin As Function Of Time

- Initial Design Safety Margin
- Actual Safety Margin at time of observation
- Required Safety Margin
- Normal Operation Requirement
- Time
- Remaining Time
- Observation Time
- Component Safety State
Components of PLIM

- Maintenance Programme
- Surveillance Programme
- In-service Inspection Programme
- Performance Review Programme
- Programme related to life management
PLIM Study Findings

- Condition of RPV & internals is satisfactory.
- Fast neutron fluence at the end of 40 EFPY will be less than threshold value for causing IASCC. RPVs have operated for around 21 EFPY.
- Generic issue of IGSCC with SS 304 piping has been addressed
- Condition of containment is satisfactory.
- Important systems are in good condition.
- AMP for power & control cables based on RLA findings.
- Replacement of equipments done based on condition monitoring:
  - SSW pumps, CRD pumps, EC tubes, FW heaters, C/U heat exchangers, Station batteries, etc
Continuous Upgradation
(Based On Operating Experience.)

- Augmentation of battery banks.
- Additional start-up transformer
- Station Black Out DG
- Augmentation of compressed air system.
- Augmentation of Reactor clean-up system.
- Augmentation of condensate demin. system
- Thermal insulation upgradation
- Augmentation of Spent Fuel Storage Facility.
Upgradations done for Life Extension

- Retrofitting 3 x 100% capacity EDGs in Seismically qualified Bldg.
- Segregation of Electrical Distribution system
- Additional CRD pump for augmenting Emergency Feed
- Segregation of Reactor Shutdown Cooling system
- Provision of Supplementary Control Room
- Segregation of Fuel Pool Cooling system
- Seismic upgrades

License to Operate extended till 2011
**Conclusion**

- Plant Life Management is a necessity on account of safety as well as economy.
- With an effective PLIM programme in place, life of NPPs can be maximized while maintaining acceptable level of safety.
- The scope of Life Management will increase as NPPs grow old and the safety standards evolve.
- The endeavor at NPCIL is to ensure that the safety standards of all NPPs remain at an acceptable level, through effective ageing management.
Thank You All!