PLANT LIFE MANAGEMENT for LONG TERM OPERATION

S.N. NUCLEARELECTRICA S.A.
ROMANIA
BACKGROUND

• S. N. NUCLEARELECTRICA S.A. (SNN) – STATE OWNED COMPANY (Public Company since 2013)

• 2 SUBSIDIARIES : - Cernavoda NPP: 2 X 706,5MW
  - Nuclear Fuel Plant in Pitesti

• NPP : - U1 - in operation since 1996;
  - GCP since in operation 90,37%;
  - shutdown for refurbishment predicted in 2023
  - U2 - in operation since 2007;
  - GCP since in operation 94,54%
  - U3&4 – planned for completion
• Development of a PLiM Program strategy for Cernavoda Unit 1 was started in 2003.
• Pilot projects for PLiM (8 projects) were initiated in 2002 (Define PLiM Program, implementation strategy and prepare generic instructions for documenting PLiM programs; Life Assessment of Major Components; Criticality Ranking of Cernavoda Unit 1 SSC; Monitoring of Maintenance Programs efficiency at system and component level; Equipment Obsolescence Identification and Prioritisation; EQ Program (EQ and Shelf Life); Passive Components Aging Management; Plant equipment data bases and systems definition reconciliation (MEL, piping and supports components database validation, prerequisite for SSC’s criticality ranking)  
• An initial acquisition strategy for PLiM components approved in 2010; revised in 2013 to cope for problems encountered;
• Plant life extension strategy was preliminary approved through BoD Decision and General Shareholders Assembly Decision (2013) – to approve PLiM planning and allocation of funds required for acquisition of remaining studies.
STRATEGY & PLANNING

• Timeframe:

  2023 – shutdown for refurbishment
  ↓
  4 to 5 years procurement and fabrication
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  2018 contract signed
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  2017 investment final approval
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  Feasibility Study approved before 2017
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  Support studies for input to FS available even sooner
LICENSING

- No specific norm available for Plant Life Extension.
- Preliminary discussions held with the Regulator:
  - NSN-02 (design and construction of NPP) and NSN-10 (PSR for NPP) will apply;
  - Norm for operation of NPP expected to be issued by Regulator in 2015, and will contain certain requirements for Plant Life Extension;
  - licensing will be supported mainly by PSR and Aging Management (integrated PLiM);
  - PSR would have to be completed early enough to allow for Regulator review, but not to early - in order to remain relevant (≈ 2021);
  - design changes will be required (dealing with severe accidents – already committed for Units 3&4);
  - certain studies will be required (site re-evaluation, exclusion zone re-evaluation)
  - Licensing Basis Document to be issued asap
Cernavoda NPP PLIM program

- Cernavoda NPP strategy to ensure critical SSCs reliability is based on WANO/INPO-AP 913 “Continuous Equipment Reliability Process” recommendations:
  - Scoping and identification of Critical Components;
  - SSC Performance Monitoring;
  - Corrective Actions;
  - Continuing Equipment Reliability Improvement (CER Process);
  - Long Term Planning and Life Cycle Management (PLiM Programmes);
  - Preventive Maintenance Implementation (PM Programmes).

- Experience from other countries has shown that, if adequate measures are taken to counteract the effects of aging and degradation on systems, structures, and components (SSCs), many plants are able to meet nuclear safety and economic efficiency requirements and operate for a long time over their design life.

- In some cases, the Preventive Maintenance Programmes are not an efficient method to mitigate the degradation mechanisms encountered in some major, very complex critical SSC.

- In these cases a Life Management Program (PLiM) has to be developed and implemented to control in a comprehensive manner the ageing process ensuring that SSCs age in a predictable manner and continue to meet the performance standards.

- Objectives:
  - implement & document technical programs for selected major Structures and Components;
  - implement and document CHM Plans for selected Structures and Components;
  - optimize CHM Plans through periodic condition assessment and remaining life assessment.
Cernavoda NPP PLIM program  
- STATUS -

- Procedures and Instructions issued to support the elements required by PLiM Program (maintaining SSC reliability, selection of critical components, critical systems health monitoring, critical components health surveillance program, plant life management);
- Major critical components selected for PLIM:
  - fuel channels
  - feeders
  - steam generators
  - HXs
  - piping (erosion-corrosion; buried pipes; supports; snubbers; expansion joints; small bore pipe)
  - cables
  - Large Power Transformers
  - Digital Control Computers (DCCs)
  - Turbogenerator
  - Reactor Building
  - SDGs (added later)
- For all selected components the program manuals were issued, except for SDGs (to be issued in 2015)
Cernavoda NPP PLIM program
- STATUS -

• Plant Life Cycle Plan approved, to ensure that activities are planned and resourced for PLiM programs implementation.

• Our approach:
  - external support from companies with proven experience (B&W, GE, CANDU etc.);
  - collaborations (COG programs for CANDU specific components: fuel channels, feeders, system chemistry; some local engineering and research companies; EPRI for HXs and piping; original equipment manufacturers)

• A typical long term complete services package (Framework Agreement) for PLiM covers life assessment evaluation, complex inspection, maintenance/repair activities and periodic condition assessment studies.
Cernavoda NPP PLIM program
- STATUS -

• Status:
  – Fuel channels: Framework Agreement in place; LA study to be issued in 2015 (first issue); revision in 2018
  – Feeders: Framework Agreement in place; LA study to be issued in 2015 (first issue); revision in 2018
  – Turbogenerator: Framework Agreement in place; LA study issued in 2012 (one recommendation with budgetary impact, related to the replacement of old Generrex system with a new generation excitation system in 2016)
  – Steam generator: Framework Agreement in place; LA study issued in 2012 (no recommendation with budgetary impact)
  – HXs: Framework Agreement in place; LA study for Main condenser issued in 2012 will be revised in 2015 to include the results of metallographic analysis (no recommendation with budgetary impact so far)
  – DCCs: Framework Agreement in place to preserve the strategic stock of Spare Parts; LA study issued in 2014 (no recommendation with budgetary impact)
  – SDGs: LA study issued in 2013 (some recommendation to improve the reliability of electronic components will be implemented on medium term, others during U1 Refurbishment Outage).
CHALLENGES

• Delays encountered in acquisition of services for program implementation (sometime due to the slow acquisition process, late validation of some programs, or new components being added to the program, etc.):
  – LA studies still to be contracted for Power Transformers and R/B;
  – Complete services for snubbers, expansion joints, cables, buried pipes.

However, execution of approved activities as identified in Program Manuals was not affected, for active nor for passive PLiM components.

Adherence to the purchasing phases is closely monitored as per the Action Plan issued and by the end of 2015 the LA studies will be obtained for the most important PLiM components: Fuel Channels, feeders, Main condenser, Reactor Building, Power Transformers.

• CTRF: Feasibility Study issued but not approved by SNN CTES.
  – Delays in project implementation will adversely impact the Refurbishment Project. Ideally, CTRF should be in service for 3 years before Refurbishment starts.
THANK YOU!