# Ageing management and LTO perspectives at Trillo NPP

**Keywords: Ageing management, lifetime management, long term operation (LTO), life extension**

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**He has more than 12 years of experience in the nuclear industry in Spain and currently works at the Almaraz and Trillo NPPs (Centrales Nucleares Almaraz Trillo).**
**His main roles includes ageing management, long term operation, environmental and seismic qualification.**

**Since 2018 he participates in various ageing management activities organized by the International Atomic Energy Agency (IAEA) and currently represents Spain in the IGALL Steering Committee.**

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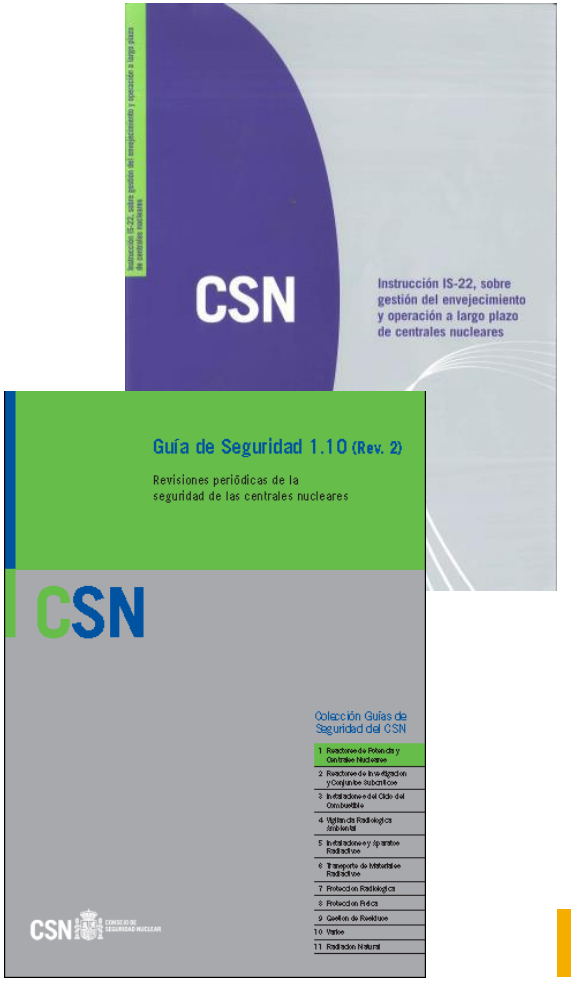
*Ageing Management = Plant Life management (PLiM) = Lifetime Management = Gestión de Vida.

* Long Term Operation (LTO) = Plant Life Extension (PLEX) = Operación a Largo Plazo.

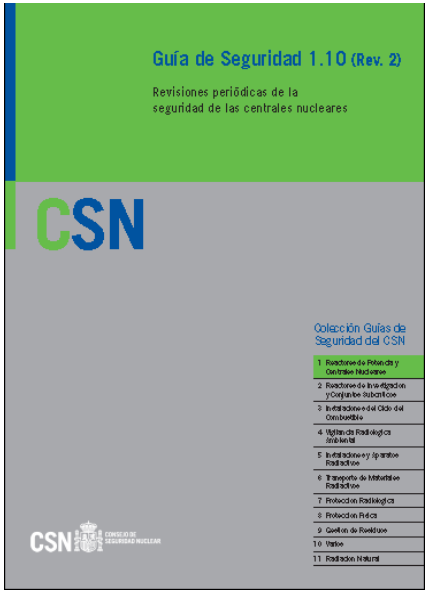
# 1. REGULATORY REQUIREMENTS FOR AGEING MANAGEMENT AND LTO IN SPAIN

Ageing Management, LTO and License renewal aspects are presently managed in Spain by the following references:

- **CSN Safety Guide 1.10** (Periodic Safety Revision of NPP), **rev. 2, May 2018.**
- **CSN Safety Instruction IS-22** (Safety Requirements for Ageing Management and LTO of NPP), **rev. 1, November 2017.**



# 1. REGULATORY REQUIREMENTS FOR AGEING MANAGEMENT AND LTO IN SPAIN




## CSN Safety Guide 1.10 Rev. 2

**Aim and content of Safety Guide:**

Establish the purpose, scope, methodology, format and time frame of the Periodic Safety Review (PSR) that Spanish NPPs shall issue

Every 10 years (according to each plants operating license)

Consistent with (IAEA) SSG-25, "Periodic Safety Review for Nuclear Power Plants "

PSR - 16 Safety Factors. 4th factor is **AGEING**

Operating license for a period of maximum 10 years is awarded after submittal of PSR.

Section 4, App 2, indicates specific requirements for the PSR in case of LTO (next license period exceeds the 40 years initial design life).

- LTO documents
- Time frame

# 1. REGULATORY REQUIREMENTS FOR AGEING MANAGEMENT AND LTO IN SPAIN

## CSN Safety Guide 1.10 Rev. 2

### LTO Documents:

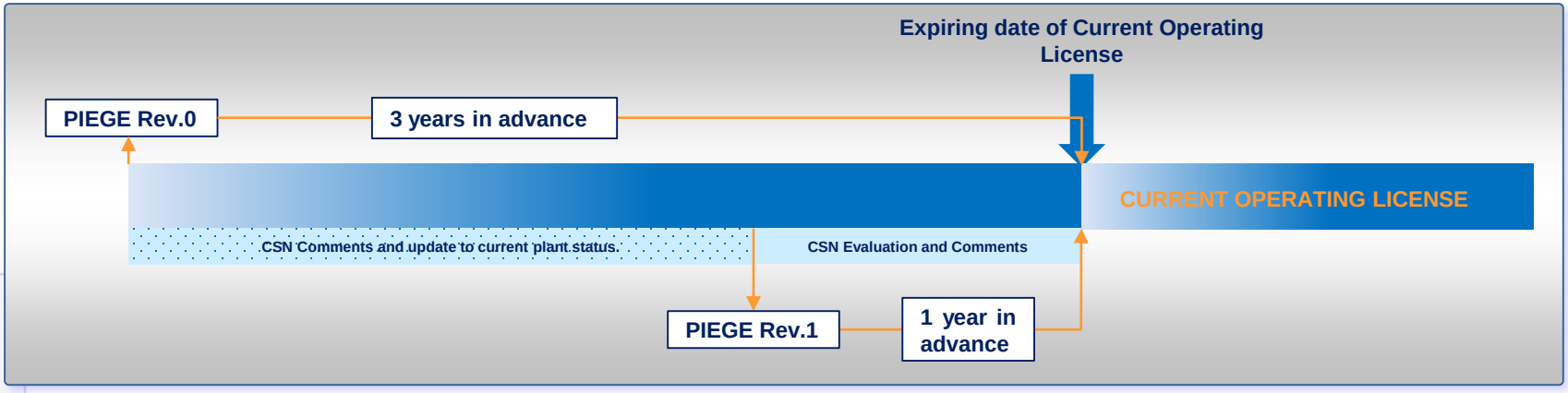
- Plan Integrado de Evaluación y Gestión del Envejecimiento (**PIEGE**). Document similar to the **US License Renewal Application.**

  **Scope + Integrated Plant Assessment (Screening, AMR and AMP) + Time Limited Ageing Analysis (TLAA).**

- FSAR Supplement - PIEGE conclusions
- Technical Specifications (TS) Review, in case that the TS requires modifications due to the PIEGE conclusions
- Long Term Radiological Impact Study
- Long Term Radwaste Plan

### Time Frame:

* CSN– Spanish Nuclear Safety Council



# 1. REGULATORY REQUIREMENTS FOR AGEING MANAGEMENT AND LTO IN SPAIN

## CSN Safety Instruction IS-22 Rev. 1

### Aim and content of Safety Instruction:

Mainly assumes 10CFR54 requirements BUT establish the criteria for the **ageing management** of nuclear power plant components during normal operation and LTO (as a continuous process).

The IS-22 included eight Sections:

- Objective + Scope
- Definitions
- Scope of ageing management Activities
- Criteria for the ageing management of nuclear power plant SSC during the **design lifetime.**
- Criteria for the ageing management of nuclear power plant SSC during **LTO**
- Ageing management reports and documentation
- Administrative aspects.
- Exemptions and equivalent measures

**During design life (40 years) - Plant Life Management Program.**

**LTO**

**Integrated Plant Assessment *(In the case of SPAIN –> PIEGE)* demonstrate that ageing will be managed adequately during the LTO period**

**+**

**Long Term Plant Ageing Management Plan based on the conclusion of the PIEGE.**

# 1. REGULATORY REQUIREMENTS FOR AGEING MANAGEMENT AND LTO IN SPAIN

## CSN Safety Instruction IS-22 Rev. 1

### NRC REFERENCES

**10CFR54 – *Requirements for Renewal of Operating License For NPP***

**Regulatory Guide 1.188** – Standard Format and Content for Applications to Renew NPP Operating License

**NUREG 1800** – Standard Review Plan for the Review of License Renewal Applications for NPP

**NUREG 1801** – Generic Ageing Lessons Learned

### INDUSTRY REFERENCES

**NEI 95-10** – Industry Guidelines for Implementing the Requirements of 10CRF part 54

**EPRI-1010639** – Non Class 1 Mechanical Implementation Guideline and Mechanical Tools

**EPRI-1013475** – Plant Support Engineering: License Renewal Electric Handbook

**EPRI-1015078** – Plant Support Engineering: Ageing Effects for Structures and Structural Components

# 2. AGEING MANAGEMENT MILESTONES

## 2. AGEING MANAGEMENT MILESTONES

Plant Life Management activities started at the Trillo NPP in the 90's according to an **industry approach** (UNESA) based on the initial License Renewal activities in the USA

2009 - CSN issued the **Safety Instruction IS-22** to regulate the Ageing Management and LTO activities at the Spanish plants.

Trillo NPP adapted existing Plant Life Management Program to IS-22 requirements, considering **NUREG-1800/1801 rev. 1**

2011-2013 - Plant Life Management Program updated considering **NUREG-1800/1801 rev. 2**

2016-2017 - Plant Life Management Program updated to consider **LR-ISG**

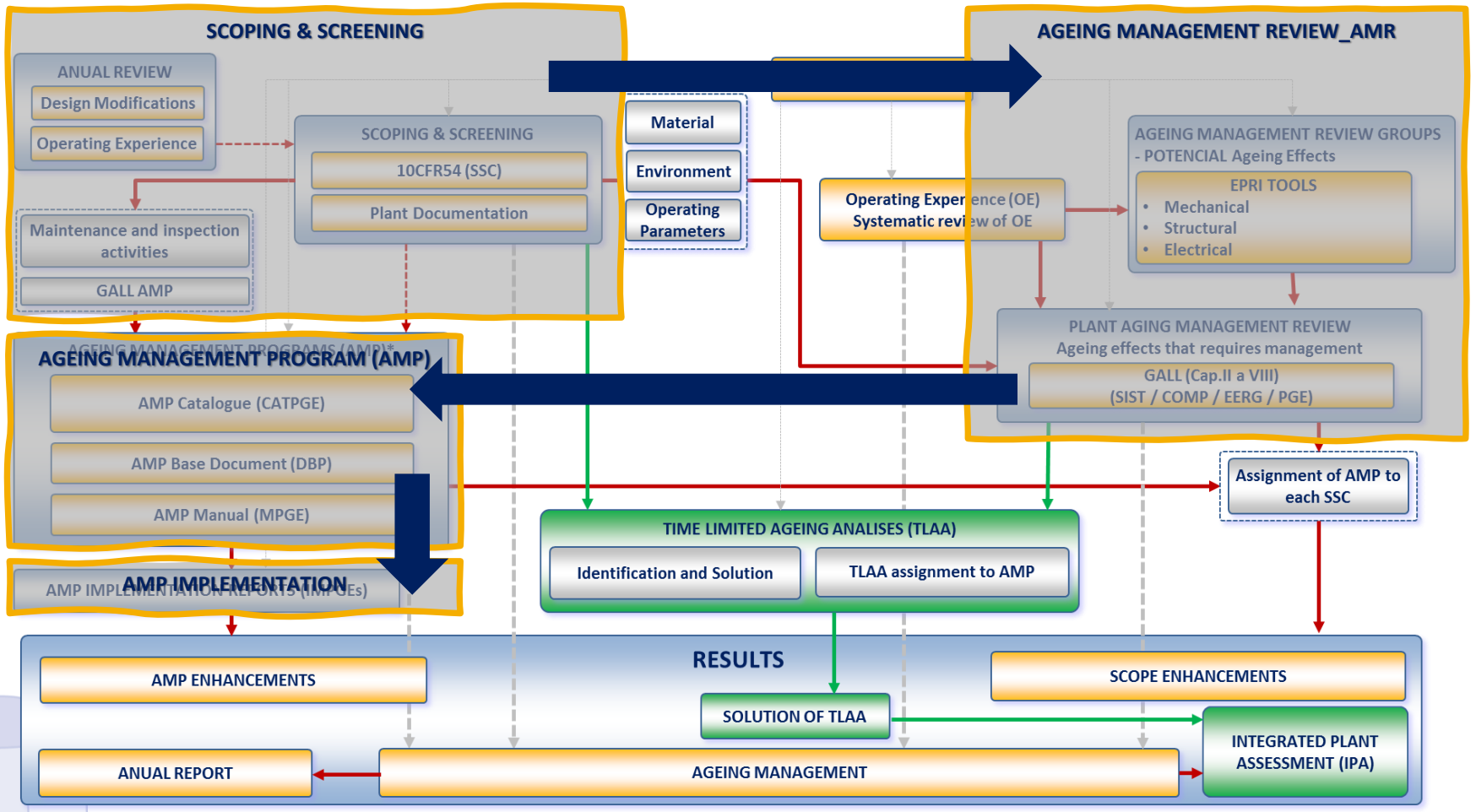
2017 - Plant Life Management Program updated considering **IS-22 rev. 1**

**Currently our Plant Life Management Program is fully implemented and forms part day to day plant activities.**

# 3. AGEING MANAGEMENT – TRILLO NPP

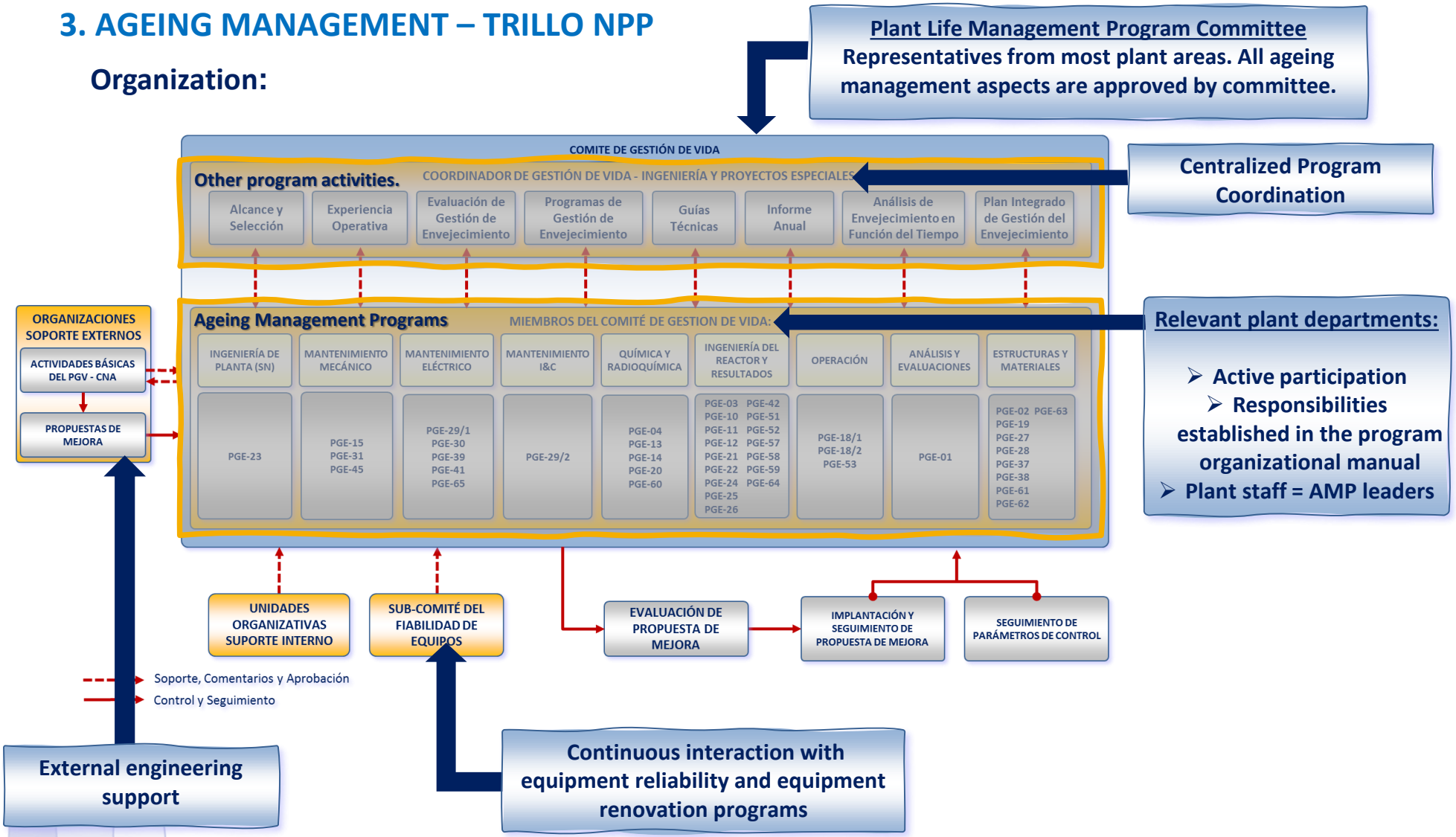
## Activities:

*Ageing Management (Trillo) = Plant Life Management Program (PGV)*

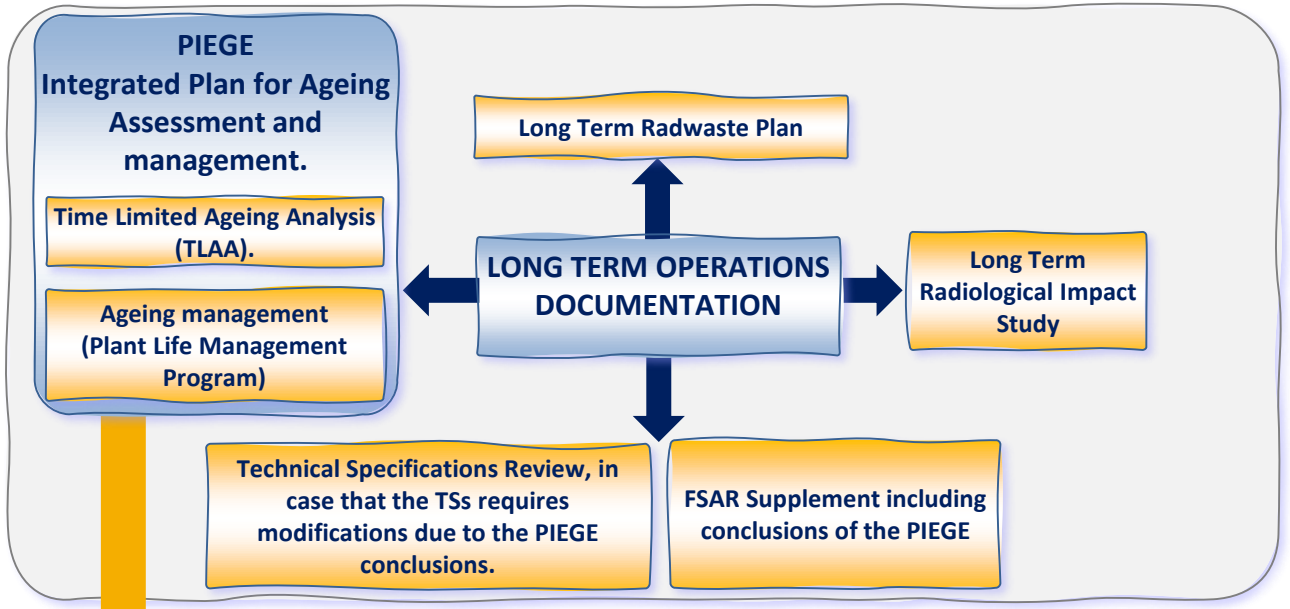


# 3. AGEING MANAGEMENT – TRILLO NPP

## Organization:



# 4. LTO – TRILLO NPP




## Integrated Plan Assessment (PIEGE)

The Integrated Plan Assessment (PIEGE), rev. 0, has been prepared in order to demonstrate that ageing will be managed adequately during the LTO period.

# 4. LTO – TRILLO NPP

## Ageing Management Programs (AMP)

| AMP | NUREG-1801 Chapter / LR-ISG | NUREG-1801 Rev. 2 / LR-ISG Program |
|---|---|---|
| PGE-01 | X.M1 | Metal Fatigue of Reactor Coolant Pressure Boundary |
| PGE-02 | N/A | Environmental condition monitoring |
| PGE-03 | XI.M1 | ASME Section XI Inservice Inspection, Subsections IWB, IWC, and IWD |
| PGE-04 | XI.M2 | Water Chemistry |
| PGE-10 | N/A | Reactor vessel internals |
| PGE-11 | XI.M17<br>LR-ISG-2012-01 | Flow-Accelerated Corrosion |
| PGE-12 | XI.M18 | Bolting Integrity |
| PGE-13 | XI.M20<br>LR-ISG-2012-02 | Open-Cycle Cooling Water System |
| PGE-14 | XI.M21A<br>LR-ISG-2012-02 | Closed Treated Water Systems |
| PGE-15 | XI.M23 | Inspection of Overhead Heavy Load and Light Load (Related to Refueling) Handling Systems |
| PGE-18/1 | XI.M26 | Fire Protection |
| PGE-18/2 | XI.M27<br>LR-ISG-2012-02 | Fire Water System |
| PGE-19 | XI.M29<br>LR-ISG-2012-02 | Aboveground Metallic Tanks |
| PGE-20 | XI.M30 | Fuel Oil Chemistry |
| PGE-22 | XI.M32 | One-Time Inspection |
| PGE-23 | XI.M41<br>LR-ISG-2015-01 | Buried and Undergroud Piping and Tanks |
| PGE-24 | XI.S1 | ASME Section XI, Subsection IWE |
| PGE-25 | XI.S3 | ASME Section XI, Subsection IWF (support inspections) |

| AMP | NUREG-1801 Chapter / LR-ISG | NUREG-1801 Rev. 2 / LR-ISG Program |
|---|---|---|
| PGE-26 | XI.S4 | 10 CFR Part 50, Appendix J (containment) |
| PGE-27 | XI.S6 | Structures Monitoring Program |
| PGE-28 | XI.S8 | Protective Coating Monitoring and Maintenance Program |
| PGE-29/1 | XI.E1 | Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements |
| PGE-29/2 | XI.E2 | Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits |
| PGE-30 | XI.E3 | Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements |
| PGE-31 | XI.M38<br>LR-ISG-2012-02 | Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components |
| PGE-37 | XI.M36<br>LR-ISG-2012-02 | External Surfaces Monitoring |
| PGE-41 | XI.E6 | Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirement |
| PGE-42 | XI.M3 | Reactor Head Closure Studs |
| PGE-45 | N/A | Programa específico de planta |
| PGE-51 | XI.M10 | Boric Acid Corrosion |
| PGE-52 | XI.M11B | Cracking of Nickel-Alloy Components and Loss of Material Due to Boric Acid-Induced Corrosion in Reactor Coolant Pressure Boundary Components (PWRs only) |
| PGE-57 | XI.M19<br>LR-ISG-2011-02 y LR-ISG-2016-01 | Steam Generator |
| PGE-58 | XI.M35 | One-time Inspection of ASME Code Class 1 Small Bore-Piping |
| PGE-60 | XI.M39 | Lubricating Oil Analysis |
| PGE-62 | XI.S5 | Masonry Walls |
| PGE-63 | XI.S7 | RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants |
| PGE-64 | XI.M40 | Monitoring of Neutron-Absorbing Materials Other than Boraflex |
| PGE-66 | AMP XI.M42<br>LR-ISG-2013-01 | Internal Coatings/Linings for In-Scope Piping, Piping Components, Heat Exchangers, and Tanks |

- **38 AMPs**
- **LTO AMPs:**

**PGE-10 - Reactor vessel internals**
**PGE-22 - One-Time Inspection**
**PGE-37 - External Surfaces Monitoring**
**PGE-41 - Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirement**
**PGE-58 - One-time Inspection of ASME Code Class 1 Small Bore-Piping**

# 4. LTO – TRILLO NPP

## Time limit Ageing Analysis (TLAAs) :

5 main groups of TLAAs → **x37 TLAAs**
**x2 requires specific management**

**Activities required as result of TLAAs:**

- **Possible update of P/T Curves**
- **Environmental fatigue: Flow Tolerance calculations, additional inspections, fatigue monitoring**
- **Environmental qualification: environmental condition monitoring, replacements, and update of plant specific AMP**
- **Transient Monitoring**

# 5. CONCLUSIONS

- Trillo NPP **maintains a Plant Life Management Program (PGV)** that has been continuously updated according to the IS-22 evolution and operating experience (internal and external)

- Integrated Plan for Ageing Assessment and management (PIEGE):
  - **Trillo NPP presented rev.0** according to time schedule indicated in the IS-22 .
  - The presented documentation is **currently being reviewed** by the Spanish Regulator.
  - An updated version of the documentation will be **submitted in march 2023**

- **Long term operation activities and inspections** will be performed during the following years and completed by 2028

- **Plant personal are responsible** for the implementation of the different AMPs which ensures that the organization is fully familiar with the Plant Life Management Program requirements.

## THANK YOU

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