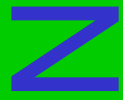


**Plant Life Management & Long Term
Operation Ageing Programmes
for Nuclear Power Plants in Spain**

**Specific case: Operating License Renewal
of Sta. M^a de Garoña NPP**

**Celia S. Linde, José M. Figueras
CSN, Spain**

Technical Meeting on activities related to
International Generic Ageing Lessons Learned Database
IAEA, Vienna, 18-20 May 2009



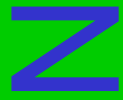
Plant Life Management & Long Term Operation
Ageing Programmes for Nuclear Power Plants in Spain

- In Spain there are **not limited term Operating Licenses** or Permits
- Operating Licenses are granted after a Periodic Safety Review (PSR), for a 10 years term



See graph in slide 13

- PSR includes plant life management programmes (PLIM) review in previous **10 year interval** as well as provisions for next interval
- Spanish PLIM programmes meet the main elements of the IAEA safety documents as well as USNRC methodology on license renewal



Plant Life Management & Long Term Operation Ageing Programmes for Nuclear Power Plants in Spain

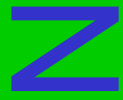
- PLIM aspects for NPP Operating License renewal up to now are driven in Spain by:

1) CSN Safety Guide 1.10 (Periodic Safety Revision of NPP), which establishes:

- **A)** “... GLOBAL SAFETY REVISIONS SHALL BE PERFORMED PERIODICALLY, IN ORDER TO EVALUATE, IN A INTEGRATED WAY, ... **AGEING MANAGEMENT PROGRAMS**, ...”
- **B)** “... ANALYSIS SHALL BE DONE FOLLOWING NATIONAL GUIDES, INTERNATIONAL CODES AND STANDARDS AND THOSE OF THE COUNTRY-OF-ORIGIN OF THE PROJECT”.
- **C)** “EQUIPMENT ANALYSIS SHALL BE PERFORMED IDENTIFYING ALL **AGEING AND DEGRADATION MECHANISMS** AND ALL **CORRECTIVE MEASURES** TAKEN OR FORESEEN”.

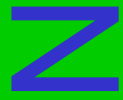
2) NPP Specific Operation Permit Conditions:

- *"A YEARLY REPORT SHALL BE SUBMITTED TO CSN, ON THE PLANT'S LIFE MANAGEMENT PROGRAM, INCLUDING:*
 - 1. *AGEING AND DEGRADATION MECHANISMS ANALYSIS AND SURVEILLANCE ON SAFETY RELATED SSC,*
 - 2. *NEW INSPECTION, SURVEILLANCE, CONDITION MONITORING AND/OR MAINTENANCE ACTIVITIES, INCORPORATED IN ORDER TO DETECT THESE MECHANISMS AND CONTROL THEIR EFFECTS".*
- *Specific Inspections on "Life Management" (biennial)*



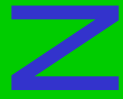
Plant Life Management & Long Term Operation Ageing Programmes for Nuclear Power Plants in Spain

- AMP rulemaking has been based:
 - Initially, on **IAEA** Safety Standard NS-R2, Safety Guide NS-G-2.10, Safety Report 15 and TECDOCS (i.e. 540, 547, 670, ...)
 - Later on (2000) when available **USA rule and reports**, on NRC License Renewal Rule 10CFR54, LR Rule SRP (NUREG-1800), GALL Report (NUREG-1801), NEI Guideline 95-10, ...
 - Also **international experience** applied (Pilot projects or LR applications from USA & other countries)



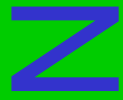
Plant Life Management & Long Term Operation Ageing Programmes for Nuclear Power Plants in Spain

- Plant Life Management (PLIM) or Ageing Management Programmes (AMP) started in Spain in a systematic way in **1992**, gaining experience with **two pilots plants**:
 - GAROÑA (BWR/GE Mk3/466 Mwe/1971)
 - VANDELLÓS 2 (PWR/W/1087 Mwe/1987)
- A generic AMR was developed by UNESA (Spanish utilities) in 1990 applicable to all Spanish NPP as a “template” and similar to the EPRI programme for US NPP, including typical four phases:
 - ✓ (1) critical **SSC selection**,
 - ✓ (2) **analysis of degradation mechanisms**,
 - ✓ (3) assessment of **maintenance practices** against ageing mechanisms,
 - ✓ (4) improvement of the practices.



Plant Life Management & Long Term Operation Ageing Programmes for Nuclear Power Plants in Spain

- Generic AMR developed by UNESA in 1990 for PLIM has been applied in all Spanish NPP since 1994.
- **Different approaches used** (assessment by categories, by systems, by commodities groups, ...) but **similar scope** (safety related SSC) and **methodology** (4 phases: scoping + screening; analysis of degradation mechanisms; assessment of maintenance practices against ageing mechanisms and improvement of the practices)
- In some cases, scope is not limited to safety objectives, and includes **economic aspects** such as impact on plant availability and replacement costs, adding some active and passive SSC to the critical list



Plant Life Management & Long Term Operation Ageing Programmes for Nuclear Power Plants in Spain

- In mid 2000 's CSN developed a **policy document** (legal, technical and administrative provisions) to cover plant life extension applications: *"Conditions for Long Term Operation of NPP"* (April 2005)
- The objectives, scope and main concepts (for both technical and administrative issues) of this safety policy document were developed through a **joint Industry/CSN** Task Force in 2003-04
- **Main objective**: In case of Long Term Operation (LTO) the licensee must prove that operation beyond plant design life (> 40 years) can be performed in accordance with prescribed regulation as well as current licensing basis, as a minimum.
- This approach required a new revision of CSN regulations and recommendations in the Periodic Safety Review, carried out every 10 years: *"Safety Guide 1.10: PSR of NPPs"* (revised Dec. 1995)



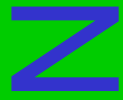
Plant Life Management & Long Term Operation Ageing Programmes for Nuclear Power Plants in Spain

- Aspects considered for LTO:
 - Content of an Integrated NPP Life Management Plan (ILMP): Aging Management Review (**AMR**) + Time Limited Aging Analyses (**TLAA**) + Environmental Impact Assessment (only Radiological)
 - Documents to be submitted: **ILMP** + **SAR supplement** (with Aging Management Programmes and TLAA results) + **Tech. Specs. Revision** + an updated **Radiological Impact Assessment** + an updated **Radioactive Waste Management Plan**, for long term operation
 - These documents shall be submitted to CSN **at least 3 years before O.P. renewal date**, and a full revision **one year before**, as part of the Periodic Safety Review package (or revised more frequently if needed)



Plant Life Management & Long Term Operation Ageing Programmes for Nuclear Power Plants in Spain

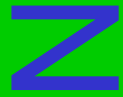
- The safety **policy document** "*Conditions for Long Term Operation of NPP*" has served as main piece of work for the recently developed **CSN Safety Instruction** NOR-08-004 "*Safety Requirements for NPP Ageing Management and Long Term Operation*" (public issuance in Spanish Gazette expected **June 2009**)
- Aspects considered are same as in the policy document. Some additional regulatory provisions are incorporated:
 - Methodology shall be based mandatory on **10 CFR 54** provisions and supporting reports: NUREG-1800, NUREG-1801 (GALL) and NEI guideline 95-10 (revision 2005)
 - WENRA aspects (coming from Reference Levels of Issue I: "*Ageing Management*") has been included
 - Recent IAEA Safety Guide NS G-2.12 (issued 2009) has been taken also into account partially



Plant Life Management & Long Term Operation Ageing Programmes for Nuclear Power Plants in Spain

- PLIM/LTO current status (1):
 - Presently (2008-09) **all Spanish NPP have finished phases 1, 2 and 3 of UNESA method** and are implementing phase 4 of improvements in their maintenance practices (*)
 - All Spanish NPP have made provisions in their AMR reports for long term operation (aiming an extension of life > 40 years, up to 50 or 60)
 - Now they use directly 10 CFR 54, NUREG 1800 and 1801 and NEI Guideline 95-10 guidance for methodology

(*) Maintenance practices are understood in general sense: typical preventive and corrective maintenance tasks plus ISI, IST, surveillance, condition monitoring, etc.



Plant Life Management & Long Term Operation Ageing Programmes for Nuclear Power Plants in Spain

- PLIM/LTO current status (2):
 - In some cases **a transition** from Spanish UNESA method (described earlier) to 10 CFR 54 method has been necessary -> some changes in scoping and screening process (i.e. active / passive SSC)
 - AMR during design life (up to ≤ 40 years) does not include TLAA and some other provisions related only for LTO

SECUENCIA DE AUTORIZACIONES DE EXPLOTACIÓN

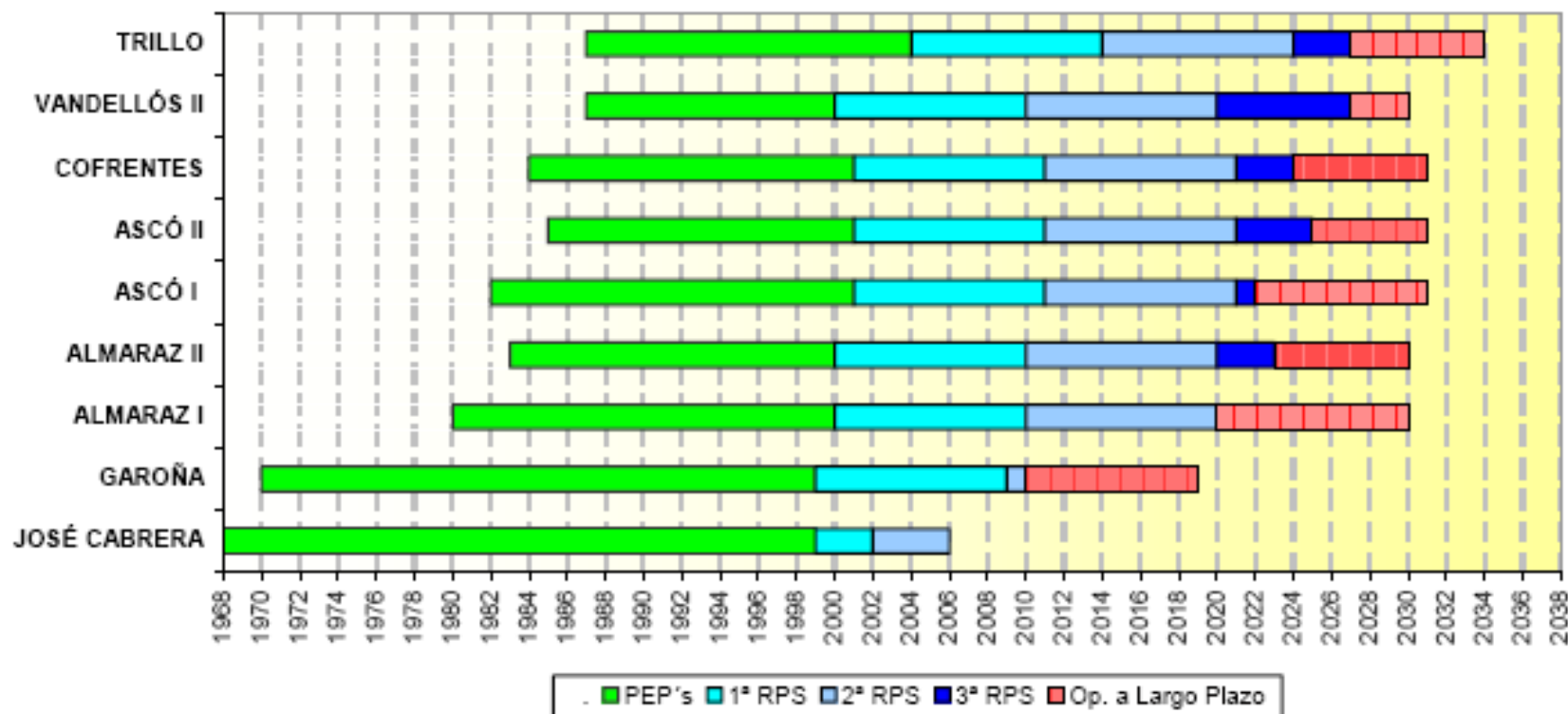
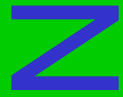
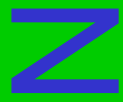


GRÁFICO 1: SECUENCIAS DE AUTORIZACIONES DE EXPLOTACIÓN



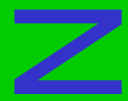
Plant Life Management & Long Term Operation
Ageing Programmes for Nuclear Power Plants in Spain

**Specific case:
Operating License Renewal
of Sta. M^a Garoña NPP**



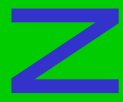
Specific case:
Operating License Renewal of Sta. M^a de Garoña NPP

- Sta. M^a Garoña NPP (characteristics):
 - Plant type: BWR-3, GE design
 - Mark I containment
 - Commercial operation: 1970
 - Design power: 1,381 MWth (469 MWe)
 - End of design life: 2011
 - Sta. M^a Garoña is the first plant applying for an Operating Permit **renewal** for Long Term Operation for **2009 – 2019** (> 40 years; up to 48)
 - O.P. renewal for LTO has been requested by the owner (Nuclenor) through Periodic Safety Review application, in 2006



Specific case: Operating License Renewal of Sta. M^a de Garoña NPP

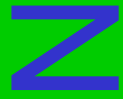




Specific case:

Operating License Renewal of Sta. M^a de Garoña NPP

- AMR for LTO period managed using **10 CFR 54 criteria** and developed using **NUREG 1800 and 1801** as well as **NEI Guideline 95-10** guidance
- Previous AMR performed under UNESA methodology was revised under 10 CFR 54 criteria -> transition needed to LTO:
 - **changes in scope and screening** (only passive SSC). Active SSC controlled by Maintenance Rule and standard maintenance programmes
 - addition of some **degradation mechanisms** (i.e. buried piping,...)
 - analysis of degradation mechanisms, identifying **28 TLAA** (25 generic + 3 plant specific)
 - definition of **43 AM Programs** for mechanical, electrical and structural components
 - 28 existing + 15 new
 - **9 of them are plant specific**, not identified in GALL
 - all are GALL consistent (10 attributes) after some enhancements



**Specific case:
Operating License Renewal of Sta. M^a de Garoña NPP**

EXAMPLES OF AM PROGRAMS

- ASME Section XI Inservice Inspection, subsections IWB,IWC and IWD
- Water Chemistry
- Reactor Head Closure Studs
- BWR Feedwater Nozzle
- BWR Vessel Internals
- Thermal Aging Embrittlement of Cast Austenitic Stainless Steel (CASS)
- Flow-Accelerated Corrosion (FAC)
- Buried Piping and Tanks Surveillance
- Structures Monitoring Program
- Fire Protection
- Inaccessible Medium Voltage Cables not subjected to 19 CFR 50.49 Environmental Qualification Requirements

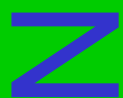
PLANT SPECIFIC PROGRAMS

- One referring to "Air Conditioning Refrigerant Units"
- Several related to "Electrical Equipment"



**Specific case:
Operating License Renewal of Sta. M^a de Garoña NPP**

NO.	EXAMPLES OF TLAА	RESOLUTION	TYPE
	Neutron embrittlement of RPV and internals		
1	USE reduction of RPV material	Extension	Generic
2	RT _{NDT} shift of RPV material	Extension	Generic
3	RPV thermal shock caused by low temperature coolant injection	Extension	Generic
4	Shroud (and tie rods) thermal shock caused by low temperature coolant injection	Validation	Generic
5	P-T curves	Extension	Generic
	Metals fatigue		
	<u>Reactor pressure vessel</u>		
6	RPV fatigue analysis	Extension	Generic
7	Recirculation outlet nozzles fatigue analysis	Extension	Generic
8	Recirculation inlet nozzles fatigue analysis	Extension	Generic
9	Feed water nozzles fatigue analysis	Extension	Generic
10	Jet pumps instrumentation nozzles fatigue analysis	Extension	Generic
11	Shroud support low cycle thermal fatigue analysis	Extension	Generic
	<u>Internals</u>		
12	Shroud tie rods low cycle thermal fatigue analysis	Validation	Generic
13	Core spray internal lines fatigue analysis	Extension	Generic
14	Nuclear instrumentation housings fatigue analysis	Extension	Specific
	<u>Piping systems and Other issues</u>		
15	Recirculation piping fatigue analysis	Extension	Generic
16	Radiation degradation of drywell polyurethane foam seal	Extension	Specific



Specific case:
Operating License Renewal of Sta. M^a de Garoña NPP

Sta. M^a de Garoña

LTO Application Tasks:

Project Plan

Methodology, Procedures, Training

Maintenance Programs review and
Operating Experience

SSCs Scoping and Screening

Ageing Management Review

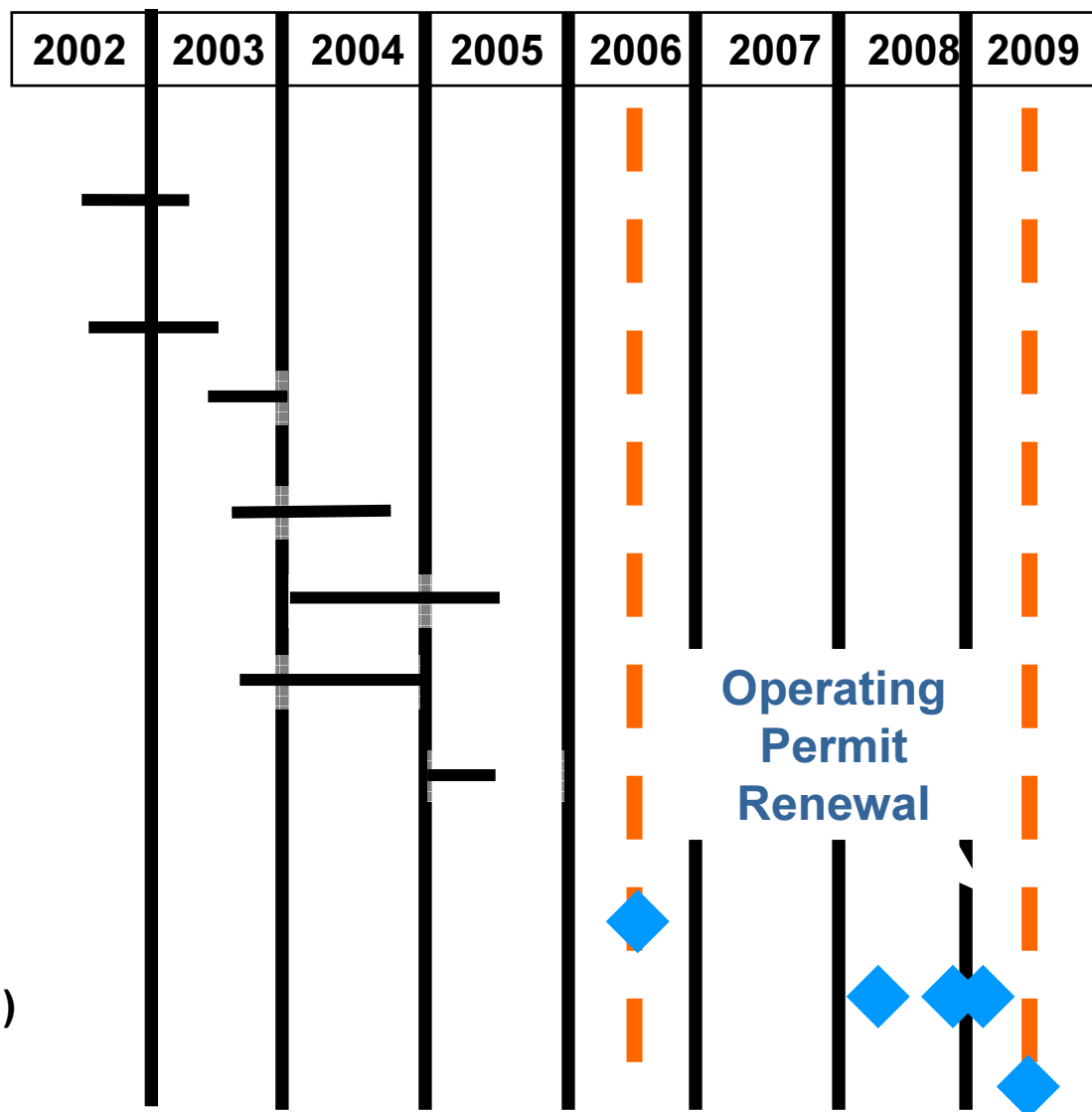
Time Limited Ageing Analysis

Prepare Periodical Safety Review
(PSR) and New Regulation Analysis

Submit Application to CSN (rev. 0)

Submit Application to CSN (revs. 1- 3)

CSN final evaluation (SER)



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