NEW SAFETY REQUIREMENTS AND LONG TERM OPERATION POLICY

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1. INTRODUCTION
2. NEW SAFETY REQUIREMENTS
3. LONG TERM OPERATION POLICY
4. THE FUTURE AFTER FUKUSHIMA EVENT
5. CONCLUSIONS
1. INTRODUCTION
1. INTRODUCTION (1/4)

Spanish N. P. P. Location

- 6 Nuclear Power Plants and 8 reactors. (± 20% Total energy produced)
- José Cabrera (Zorita) in decommisioning process.
- Almaraz N. P. P. is a part of CNAT AIE (Almaraz + Trillo)
### ALMARAZ N. P. P. Features

- 2 Pressurized Water Reactors (PWR).
- Westinghouse Design/Technology 3 loops.
- Thermal power: 2.947 Mw (Unit 1 y Unit 2)

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**Photography:** Panoramic view
ALMARAZ N. P. P. Features

- **Unit 1**:  
  - 1045 Mwe  
  - Network synchronization 01/05/81  
  - Load factor in recent 20 years: 91.23 %

- **Unit 2**:  
  - 1045 Mwe  
  - Network synchronization 08/10/83  
  - Load factor in recent 20 years: 91.52 %

“Almaraz N. P. P. is the unique plant that has contributed to the network in Spain with over 400.000 Gwh” (2011)
2. NEW SAFETY REQUIREMENTS
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- In Spain there is a single regulatory body the Nuclear Safety Council (CSN).

- The CSN reports directly to Spanish Parliament and is the only competent organism in the supervision and regulation of Nuclear Power Plants (NPP).

- In Spain there are no permanent Operating Licenses are renewed every 10 years.

- The licence renewal process requires the edition by holders of a report called Periodic Safety Review (PSR) which must be submitted to the CSN review, at least 1 year before the expiration of the licence.

- The RPS is a thorough analysis of the last 10 years of operation and must demonstrate that the safety of the NPP are better than those they had in the previous license renewal, as required by the CSN.
2. NEW SAFETY REQUIREMENTS (2/3)

- The CSN also requires conducting a review of the Conditional Application Policy (CAP), that is, to review the new regulations applicable to the NPP and to adapt it to that regulation if is possible.

- New safety improvements required by the CSN renewal are part as an attachment called Complementary Technical Instruction (ITC) to the license amendment.

- The ITC includes the scheduling of implementation of the MD (design modifications), evaluations, etc. that holders should take to comply with licence renewal.

- In cases of significant improvements to the nuclear safety CSN conditioned, the continuity of the operation of the Plant to implement the new features within the time limits involved.
- This type of regulation requires to the holders a continuously adaptation the Plants to the state of art regarding to nuclear safety and requires major economic investments.

- Some examples of improvements implemented in Almaraz NPP:
  * Severe Accident Management Guides.
  * New startup transformer.
  * Renewal of the remote shutdown panel.
  * Adaptation to the NFPA-805.
3. LONG TERM OPERATION POLICY
Since the beginning of commercial operation Almaraz NPP goal has been to have the plant fully update to operate for many years.

From the beginning have been installed 6000 MD (design modifications), some as relevant as SGR (Steam Generators Replacement), RVHR (Reactor Vessel Heads Replacement) and new turbines, main condensers, secondary side heaters, etc.

The technological innovation has continued in recent years and they have been incorporated the latest technologies and new ESC to ensure the safety, availability and long-term operation.

Some very relevant examples are: the 5th GD (diesel generator) emergency, the incorporation of digital control in primary and secondary, the replacement of electric generators and all their auxiliary systems, the main transformers and the refueling outage tools an equipments replacement.
3. LONG TERM OPERATION POLICY (2/10)

TECHNOLOGY UPDATE

FIVE DIESEL GENERATOR IMPLEMENTATION

REHEATER REPLACEMENT

LONG TERM OPERATIVE
DIGITAL CONTROL
TURBINE/REACTOR

DIESEL
SWITCHGEAR
380V / 6,3kV

RENEWAL
MAIN
TRANSFORMERS

DIGITAL CONTROL
TURBO PUMPS
3. LONG TERM OPERATION POLICY (4/10)

POWER UP RATING 2009 - 2010

- **NEW MSR’S,**
  SUPPLIER: **TEI**

- ADDRESSING DEGRADATION PHENOMENA (E / C, VIBRATING).
- PERFORMANCE IMPROVEMENT.
- NEW DIGITAL CONTROL SYSTEM.
- REPLACED BOTH UNITS.
- INCREASE 10 MWe.
3. LONG TERM OPERATION POLICY (5/10)

POWER UP RATING

- **NEW ELECTRIC GENERATOR**
  - SUPPLIER: SIEMENS

SCOPE:
- NEW STATOR AND EXCITER
- REWIND ROTORS
- NEW WATER COOLING COIL UNIT
- NEW UNIT OF HYDROGEN SEAL OIL
3. LONG TERM OPERATION POLICY  (6/10)

POWER UP RATING

NEW

ELECTRIC GENERATOR & EXCITER
Increased flow and lower vapor pressure

Improving Performance (7MWe)

Improved efficiency

Improved sealing system

Power up rating

New High Pressure Turbine

Supplier: Siemens

Turbine adapting to new terms of steam

- Increased flow and lower vapor pressure
- Improved sealing system
- Improved efficiency
- Improving Performance (7MWe)

New blade of three-dimensional design (3DS)

- Improvement of the radial pressure gradient
- Reduction of secondary losses blade ends
3. LONG TERM OPERATION POLICY (8/10)

POWER UP RATING

NEW CONDENSATE PUMPS

NEW HEATERS DRAIN PUMPS

NEW COOLING SYSTEM
- In parallel with technical changes, has undertaken a first generational renewal in Plant and Headquarters.

- A correct management of generational renewal is critical due to the importance that experience has in the nuclear industry.

- In Almaraz NPP, has been renewed since 2001 approximately 25% of the original personnel in an orderly manner with retention periods of 5 years to ensure proper knowledge transfer and a consistent overlap.

- There is a new long-term plan for generational renewal in Almaraz NPP up to 2020 (year of expiration of the current operating license).
3. LONG TERM OPERATION POLICY  (10/10)

HUMAN FACTORS

Our objective:

Human factors and organization program

Minimizing human error and its impact

Error prevention tools: (DGE-20)

1. Prejob briefing / work packages
2. Verification techniques.
3. Three-way communication / Alphabet.
4. Questioning attitude.
5. Conservative decisions.

Major activities:
Self-assessments, benchmarking, expectations, training, awareness campaigns, commanding presence in the field, etc.
4. THE FUTURE AFTER FUKUSHIMA EVENT
- The Fukushima Daichi NPP event has meaning a before and after for nuclear industry. Nothing will be the same after Fukushima.

- The consequences for the nuclear industry, at least in the EU (Germany, Belgium?...), are only comparable to the new scenarios, far beyond the design basis against which we must become more robust.

- The Fukushima event has 3 main distinguishing features such as TMI or Chernobyl.

- It was caused by natural phenomena and not was caused by human error.

- A single fact ended all barriers of defense in depth.

- It is attributable to a design flaw.
- Preliminary results of the “Stress Test” have confirmed the robustness of the Spanish NPP and among them for Almaraz NPP.

- As a result of the “Stress Test” will be implement further improvements in the Spanish NPP that make it even more resistant than they already are, to the occurrence of external phenomena, as improbable as they were before the Fukushima event.

- At the recent biennial meeting of the WANO (World Association of Nuclear Operators) held in Shenzhen (China) has been agreed by all members the following measures:

  *Reduction internals for “Peer Reviews” from 6 to 4 years with “Follow Up” intermediate.
  * Substantial increase engineers in WANO regional centers.
  * New areas of review in the “Peer Review”:
    * Emergency preparedness.
    * Spent Fuel Pits Design.
    * Pre start up “Peer Review”.
- The nuclear world (Regulators, Industry, Suppliers, International Organizations, etc) has shown a proactive and very quick reaction after the Fukushima event, but the future for our industry today is a big unknown.
5. CONCLUSIONS
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- New safety requirements are not something that comes after the Fukushima event, CSN has been applied in the renewals of operating licences in Spain a type of regulation that requires the owners of the NPP constantly adapted to the state of art in Nuclear Safety and Radiation Protection.

- Policies for long-term operation require continuous updating of the NPP, both in the “hardware” Equipment, System and Components (ESC) and in the “software” (Human Resources). The NPP are now much safer an reliable than they were when they started up and regulatory requirements are also much more restrictive and demanding as least in Spain.

- The Spanish NPP are very robust and will be more as a result of the “Stress Test”.

- The Nuclear World has responded very proactive and quick to Fukushima event, beyond compare to other types of industries that have suffered catastrophic events with very serious consequences, but...

- The future of nuclear energy is presented, at least in the EU, very uncertain and the future it is not in our hands, perhaps the passage of time and a perspective vision in a few years can to change this uncertainty. In this trust.
Tank you for your attention.