MAIN ACTIONS TO IMPROVE ACCIDENT MANAGEMENT IN SPAIN AFTER FUKUSHIMA
1. REGULATORY RESPONSE AFTER FUKUSHIMA
   a) Regulatory Commitment with Europe
   b) Requirements: ITC 1/3, ITC 2/4, ITC 5
   c) Design criteria
   d) CSN supervision process
   e) CSN organization

2. SPANISH NUCLEAR POWER PLANTS RESPONSE
   a) Response to ITC 3 ITC 2/4
   b) Procedures
   c) Analyses
   d) Main modifications in the Spanish NPP
   e) Radiation protection issues
   f) Periodic information
NUCLEAR FLEET IN SPAIN

NPPs & FUEL CYCLE FACILITIES:

• 7 REACTORS IN OPERATION (5 SITES)
  - 2 TECHNOLOGIES (PWR & BWR)
  - 3 SUPPLIERS (W, GE, KWU)

• 1 REACTOR SHUTDOWN

• 1 REACTOR BEING DECOMMISSIONED

• 1 REACTOR DISMANTLED

• 1 FUEL FABRICATION PLANT

PWR NPP (W)
(degraded: same site)
PWR NPP (KWU)
BWR NPP (GE)
BWR NPP SHUTDOWN (GE)
NPP (IN DECOM.)
NPP DISMANTLED
FUEL FACTORY
REGULATORY RESPONSE AFTER FUKUSHIMA

a) COMMITMENT WITH EUROPE

- STRESS TEST - NATIONAL REPORT - PEER REVIEW – NATIONAL ACTION PLAN

- WENRA (Western Europe Nuclear Regulators Association)
  Reference levels review under Fukushima events light
  (May, 2012 - October, 2013)

Current CSN participation in working groups under RHWG:
  - I4: Mutual assistance
  - T1: Natural hazards
  - T2: Containment in severe accidents
  - T3: Accident management
b) **REGULATORY REQUIREMENTS: ITC 1/3, ITC 2/4, ITC 5**

- Regulatory requirements associated to the NPP operating licence ("Orders")
- Specific for every NPP
- Post-Fukushima European stress tests: ITC 1 and ITC 3
- Large explosions or fires beyond design bases: ITC 2 and ITC 4
- Currently under CSN consideration: ITC 5
REGULATORY RESPONSE. b) Regulatory requirements

POST-FUKUSHIMA: ITC 1 AND ITC 3

✓ ITC 1: Stress test (lessons learnt from the Fukushima events)
  - May, 2011 to NPP
  - June, 2011 to Jose Cabrera and Juzbado
  - Closed interaction between CSN and licensees

✓ ITC 3: Specific requirements derived from the Stress tests conclusions
  - March, 2012
  - Extreme natural hazards, prolonged and total SBO, loss of UHS
  - Accident management (reactor/containment and fuel pool storage)
  - Two types of requirements:
    i) Analysis and subsequently improvements (modifications);
    ii) Modifications
  - Short (2012), medium (2014) and long (2016) terms requirements
01 REGULATORY RESPONSE. b) Regulatory requirements

- LARGE EXPLOSIONS OR FIRES BEYOND DESIGN BASES: ITC 2 AND ITC 4

  ✓ ITC 2: “Potential loss of big areas in the NPP”
    - July, 2011
    - Confidentiality
    - NEI 06-12, rev.2 “B.5.b phase 2&3 submittal guideline” as reference
    - Requires analysis and modifications depending on the results, covering:
      - Emergency management
      - Large fires extinction
      - Fuel damage mitigation
      - Mitigation of radioactive releases

  ✓ ITC 4: “Potential loss of big areas in the NPP”
    - July, 2012
    - Some additional requirements/clarifications not included previously in ITC 2
REGULATORY RESPONSE. b) Regulatory requirements

**ITC 5**

- In force for CNSMG (July, 2013)*
  - Compilation of ITC 2/4 and 3 requirements
  - Adaptation of these previous orders to its new operational situation
  - Consistency between the two processes
  - Relief of confidentiality requirements
  - Abolition of ITC 2/4 and 3
- Under CSN consideration for the rest of NPP

* CNSMG has been in “permanently ceased operation” since July 6th, 2013
c) DESIGN CRITERIA FOR PLANT MODIFICATIONS

- CSN is developing criteria as a minimum to fulfil some ITC 2/4 and 3 requirements
- NPP collaboration
- Applicable to physical design modifications
- Double purpose: Design (utility) and acceptance criteria (CSN)
- General application criteria:
  - For new or pre-existing equipment/system, fixed or mobile, considered in the analysis
  - Assuring robustness against postulated events (extreme natural hazards, prolonged and total SBO, loss of UHS, events with loss of big areas)
  - Requirements in terms of functionality, availability, “qualification”.....

- Specific criteria to design:
  - On site alternative management centre (CAGE)
  - Filtered containment venting systems (FCVS)
  - Passive autocatalytic recombiners (PAR)
d) CSN SUPERVISION PROCESS

- CSN has developed a detailed guidance to fulfil the supervision process
- Inspection and Evaluation specific program
  - Several annual inspections to every NPP on ITC 2/4 and 3 requirements (different inspection teams depending on the topic)
  - Evaluation on some ITC 2/4 and 3 requirements
  - CSN formal acceptance on some design modifications
e) CSN ORGANIZATION

- No changes in the normal organization of CSN
- Different departments affected
- Supervision process responsibilities defined in the guide
1. REGULATORY RESPONSE AFTER FUKUSHIMA
   a) Commitment with Europe
   b) Regulatory requirements: ITC 1/3, ITC 2/4, ITC 5
   c) Design criteria
   d) CSN supervision process
   e) CSN organization

2. SPANISH NUCLEAR POWER PLANTS RESPONSE
   a) Response to ITC 3 ITC 2/4
   b) Procedures
   c) Analyses
   d) Main modifications in the Spanish NPP
   e) Radiation protection issues
   f) Periodic information
NPP RESPONSE

a) RESPONSE TO ITC 3 ITC 2/4

- Specific response from every NPP
- Most of the NPP proposed changes fulfil ITC 3 and ITC 2/4 requirements simultaneously
  - Planning for accident management (organization, human resources, training, facilities)
  - Procedures (EOPs – SAMG – EDMG)
  - Physical Design Modifications
- Time frame: a few of authorized delays on some specific requirements. Not compromised final dates (2016)
b) PROCEDURES

- W-PWR and GE-BWR: review of their existing EOP-SAMG under OG reference (new revision includes SFP)
- KWU-PWR: Developing new symptom based SAMG. Long term
- NPP developing EDMG (extensive damage mitigation guides): short/medium term
  - Different models/structures of EDMG depending on the NPP design
  - Portable equipment
  - Fuel damage prevention/mitigation
  - Fire/explosion/security
  - Radiological issues
c) ADDITIONAL ANALYSIS

- In response to some CSN requirements (ITC 3 and 2/4)
- Short and medium term
- Implementation of improvements (modifications) identified in the analysis: medium and long term
- Examples of some kind of analyses:
  - Natural Hazards
    - Potential and large internal flooding
    - Harmonization between scenarios of dam breaking consider under stress test and considered under the dam emergency plans
    - Combination of another potential extreme natural hazards (extreme temperatures, rain, snow, wind,...)
02 NPP RESPONSE. c) Analysis

✓ Planning for accident management
  o Human resources required to reinforce the NPP emergency organizations
  o Access routes towards the plant under extreme natural hazards
  o Mutual assistance (among Spanish NPP)
  o Communication resources (on-site & external)

✓ Severe accidents
  o Alternatives to depressurize the RCS under total SBO and earthquake
  o Use of seismic FPS (fire protection systems) to inject/spray water in the RPV/containment/SFP
  o Hydrogen leaks to neighbour buildings
  o Severe accidents in shutdown states
Severe accidents (cont)
- Critical instrumentation for severe accident management
- Instrumentation in containment under severe accident conditions
- Closure of containment under total SBO (whatever operational mode: normal operation, start-up, hot/cold shutdown and, mainly, refuelling outage)
- Containment integrity under severe accident conditions (leak tightness)

Storage fuel pool
- Reinforcement of the instrumentation (temperature, level and radiation) under severe accident scenario and total SBO

Radiological protection
- Analysis of additional radiological protection resources and equipment
- Analysis of the resources needed to estimate radioactive emissions
d) MAIN DESIGN MODIFICATIONS IN THE SPANISH NPP

- Design criteria for physical design modifications: Developed by CSN with NPP participation
- Emergency management: On site alternative emergency centre
  - Specific design criteria (functionality, availability, “qualification”, radiological aspects)
  - For potential loss of big areas in the NPP and for extreme natural hazards
  - Not an alternative emergency control room
  - Final date: long term (2016)
- Prevention/mitigation severe accident scenarios
  - General and/or specific design criteria (functionality, availability, “qualification”)
  - Reactor/containment/spent fuel pool
  - Mobile/fixed, new or adapted, equipment to respond against postulated events (extreme natural hazards, prolonged and total SBO, loss of UHS, loss of big areas)
NPP RESPONSE. d) Main design modifications

- Examples of design modifications under developing currently in the Spanish NPP:

  - New FCVS (or up-graded in CN Cofrentes). 2016
  - H₂ control: PAR inside containment. 2016. Exceptions: CN Trillo (it has PAR currently)
  - New portable equipment and new procedures to inject/spray water into the RPV/SG/containment/SFP (motor driven pumps/connections/hoses). 2012-2013
  - Connection of seismic FPS to inject/spray water into the RPV/SG/containment/SFP
  - Minor modifications and new procedures to allow water injection to RPV/SG by using the pre-existing turbine driven pumps without DC power (manually operated). 2012-2013
  - Improvements in PWR-W RCP seals. 2014
  - New or upgraded instrumentation for critical parameters/new portable equipment and or procedures to alternatively obtain critical values. 2012-2013
  - Storage for portable equipment
Examples of design modifications under developing currently in the NPP Spanish plant: Supporting systems

- Reinforced off-site power supplies (new procedures to quickly recover off-site power)
- New mobile electrical power supply (mobile diesel generators for AC/batteries or MDG+battery charger for DC/connections) for mobile/fixed equipment, including instrumentation. 2012-2013
- New mobile fuel supply (tanker) for mobile/fixed equipment. 2012-2013
- New mobile lightening systems for exterior use. 2012-2013
- New alternative air supply (portable compressors/accumulators/connections) for pneumatic equipment. 2012-2013
- New connections for alternative water supply (from different pre-existing tanks or water deposits). 2012-2013
NPP RESPONSE

e) RADIATION PROTECTION ISSUES

- Reinforce the electrical supply to the main control room habitability system. 2012-2013
- Reinforce the electrical power supply to essential radiological surveillance equipment 2012-2013
- Containment filtered venting
- External spray of the containment and another buildings with potential radiological risk
- Confinement/treatment of the radioactive liquid waste
- Development of radiological guidelines for severe conditions actuations (under SAMG strategies)
f) PERIODIC INFORMATION

The Spanish NPP are submitting periodically (every six months) a report summarizing the advance state of their activities related to the ITC 2/4 and ITC 3, as required by CSN.
Thank you for your attention

Questions?