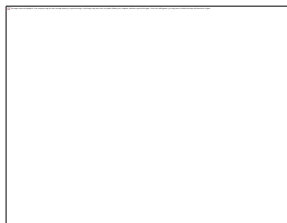




# *U.S. EPR EQ Program Update*

*Nissen M. Burstein  
Technical Consultant*

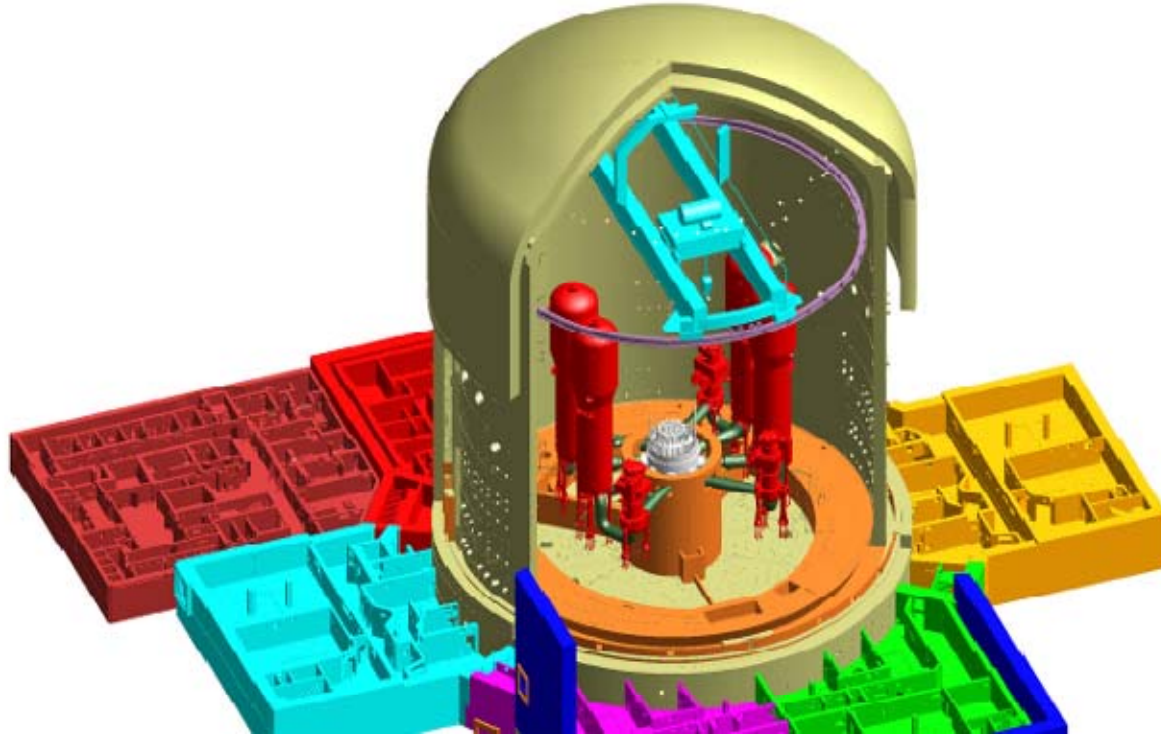
**Presented at SC-2, Meeting 10-01  
April 20, 2010, Las Vegas, NV**



EPR is a trademark of the AREVA Group.

# Overview of U.S. EPR™ Reactor

- ▶ Redundant safety systems are physically separated into four divisions, which protect the individual integrity of the electrical and mechanical safety systems.



The four divisions of safety systems are consistent with an N+2 safety concept.

One division can be out of service for maintenance

One division can fail to operate

The remaining two divisions are available to perform the necessary safety functions even if one of the two remaining trains becomes inoperable due to the initiating event.

# Overview of the U.S. EPR™ Design

- ▶ Evolutionary 4-loop PWR designed for a rated core thermal power level of 4590 MWt.
- ▶ The U.S. EPR™ unique design features include:
  - ◆ Four redundant trains of emergency core cooling.
  - ◆ Containment and shield building.
  - ◆ Core melt retention system for severe accident mitigation.
- ▶ The plant design objective is 60 years. The design provides for the replaceability of major components, including the steam generators.
- ▶ The Reactor Building is an integrated structure consisting of an inner Reactor Containment Building, an outer building called the Reactor Shield Building, and an annular space between the two buildings that separates them for protection against external hazards (including aircraft impact).



# Projects

**4 EPR™ Reactors under construction**



**Flamanville 3**



**Olkiluoto 3**



**Taishan 1&2**



# General Orientation – Olkiluoto Island



# Olkiluoto 3 Project - General View





# OL3 Project Photo Update



LEFT: Safeguard Building  
BOTTOM: Reactor Pit  
February 2010

# EPR™ Flamanville 3 Project





# Flamanville 3 Project - General View



Flamanville 3



»» The first EPR™ plant to be built in France

# FA3 Project Progress



Reactor Building APC shell height +23.15 meters  
Personnel: 11 AREVA employees on site; expected peak mobilization in 2010 of 400 AREVA employees and suppliers  
Engineering 84% complete  
76% of orders placed  
Installation of the first embedded tank (RPE)

Setting up of emergency cooling system in the pumping station

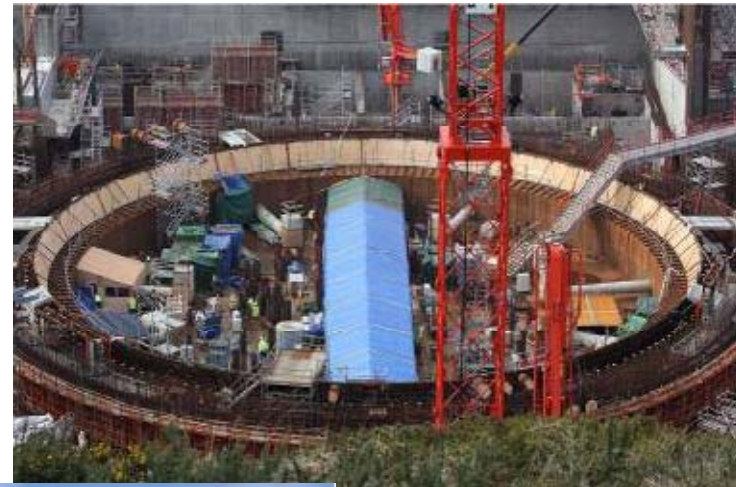
**February 2010**



# FA3 Project Photo Update



RIGHT: Reactor Building  
BOTTOM: General View,  
East/West  
February 2010





# Taishan 1&2 Project





# Taishan Project Progress



Orders placed by AREVA: 71%

Orders (in euros) placed by our partner within the Consortium: 70%

Detailed design: ~34 % completed

Start of the engineering activities in China with Consortium partner

All primary equipments of Units 1&2 being manufactured



# Taishan Project Photo Update



RIGHT: Nuclear Island Main  
Structure Construction  
BOTTOM: Plant Overview  
February 2010



# Equipment Manufacturing



**Machining of Heavy Equipment**

## Highlights of Recent U.S. EPR Activity General



- ▶ **The U.S. EPR design application is currently under NRC review.**
  - ◆ **As of 3/26/10, we have a total of 3572 formal RAIs and 106 open items. AREVA has responded to 3331 RAIs and 18 open items. .**
  - ◆ **Phase 1 review of the application, i.e., preliminary SER and all RAIs issued, was completed on 1/28/09. Phase 2 review (i.e., development of the SER with open items) is currently in progress.**
  - ◆ **A total of ten chapter SERs with open items have been received to date and seven associated ACRS meetings completed.**
  - ◆ **Schedule date for NRC approval of the design application is December 2011.**
  - ◆ **Key issues involve civil-structural, large break LOCA, fuel burnup (M5 growth issue), I&C, Human factors engineering, new and spent fuel storage racks, and resolution of GSI-191 related to sump strainer clogging.**
  - ◆ **Of the 11 active topical reports, 6 have been approved, one has recently been issued a draft SER, 4 are under active review.**





# Regulatory Status Regarding ASME QME-1 2007



- ▶ **AREVA NP is currently assessing Revision 3 of RG 1.100 and its impact and also monitoring responses from other design certification applicants.**
- ▶ **AREVA NP uses ASME QME-1-2007 as guidance for qualifying active mechanical equipment with the exception that a separate mechanical equipment qualification (MEQ) program for the U.S. EPR™ design will not be maintained, as noted in U.S. EPR™ FSAR Tier 2 Section 3.11.2.2.**



# Engineering Implementation of ASME QME-1 2007



- ▶ **IEEE Standards 323-1974, 334-2006, 344-2004, and 382-2006 are used for qualification.**
- ▶ **Environmental Qualification (EQ)**
  - ◆ **EQ of electrical appurtenances meets the requirements of IEEE 323-1974.**
  - ◆ **EQ of the valve actuator meets the requirements of IEEE 382-2006.**
  - ◆ **EQ of the pump motor meets the requirements of IEEE 334-2006.**
  - ◆ **EQ of the valve is limited to the nonmetallic parts of the valve. EQ follows the guidance of non-mandatory Appendix QR-B of QME-1 for nonmetallic parts of the valve.**



# Engineering Implementation of ASME QME-1 2007



## ▶ Seismic Qualification

- ◆ Seismic qualification performed in accordance with the requirements of IEEE 344-2004 and the guidance of RG 1.100.
- ◆ No earthquake experience based qualification allowed.
- ◆ Static deflection testing using QME-1-2002 as guidance is acceptable.

## ▶ Operability testing

- ◆ Follows the guidance of QME-1 2007 while being subjected to mechanical and operating loads (i.e., connecting pipe loads), design conditions or differential pressures as specified on the equipment data sheets, and the seismic accelerations specified.



## Highlights of Recent U.S. EPR Activity EQ Related



- ▶ **Total of 33 questions issued to address EQ, Section 3.11, with the most notable being:**
  - ◆ **Use of latest IEEE Stds, vs. use of only those endorsed by RG. Based on discussions with NRC we have been told we must use the 1974 version of IEEE Std 323.**
  - ◆ **Qualification of mechanical equipment.**
  - ◆ **EQ of severe accident equipment. Revised FSAR to specifically state that severe accident equipment is not required to be environmentally qualified per 10 CFR 50.49**
  - ◆ **HF Seismic position was provided by 10/31/09.**
  - ◆ **Program to address mechanical equipment qual and QME-1. NRC recently issued RG 1.100 Rev. 3 to endorse QME-1 2007, AREVA NP currently evaluating the impact; preparing “white paper” to address.**
  - ◆ **Addressing, by ITAAC, the length of time for which the function of each mechanical component is required.**







## ▶ AREVA's High-End Bet on Nuclear Power

### ◆ Article appeared in BusinessWeek, March 9, 2010

- “Such souped-up safety features were key in convincing Baltimore-based Constellation Energy Group (CEG) to go with an EPR for an expansion of its Calvert Cliffs plant in southern Maryland. The company is in advanced talks to obtain federal loan guarantees, with an eye toward opening the facility by 2017. Despite the cost, some \$10 billion, ‘once that investment is made, we’ll have a highly reliable plant,’ says Michael J. Wallace, Constellation’s chief operating officer.”
- “To garner support for the EPR among potential subcontractors, Lauvergeon organized ‘supplier days’ last year in Maryland and Ohio. And last summer she invited high school students from Idaho—home to a planned Areva uranium enrichment plant—to visit similar facilities in France. Compared with its rivals, ‘Areva is more attuned to the public relations side of things,’ says Adrian Heymer of the Nuclear Energy Institute, a trade group in Washington.”

