The UK EPR™ Design developed by EDF & AREVA

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EPR™ and the GDA process

- **The EPR™ is a Generation 3+ Pressurised Water Reactor (PWR) design**
- **Design began in 1992 as joint project between French and German power companies and reactor vendors**
  - Design a next-generation PWR suitable for deployment in Europe post 2000
  - Evolutionary development of the most modern French and German PWRs (N4 and Konvoi designs)
- **French and German Nuclear Safety Authorities reviewed the proposals from an early stage to ensure harmonisation with European safety standards**
- **In 2007, EDF and AREVA jointly applied for UK GDA for the UK EPR™ based on the EPR™ being constructed at Flamanville in France**

EPRs™ under construction in the world

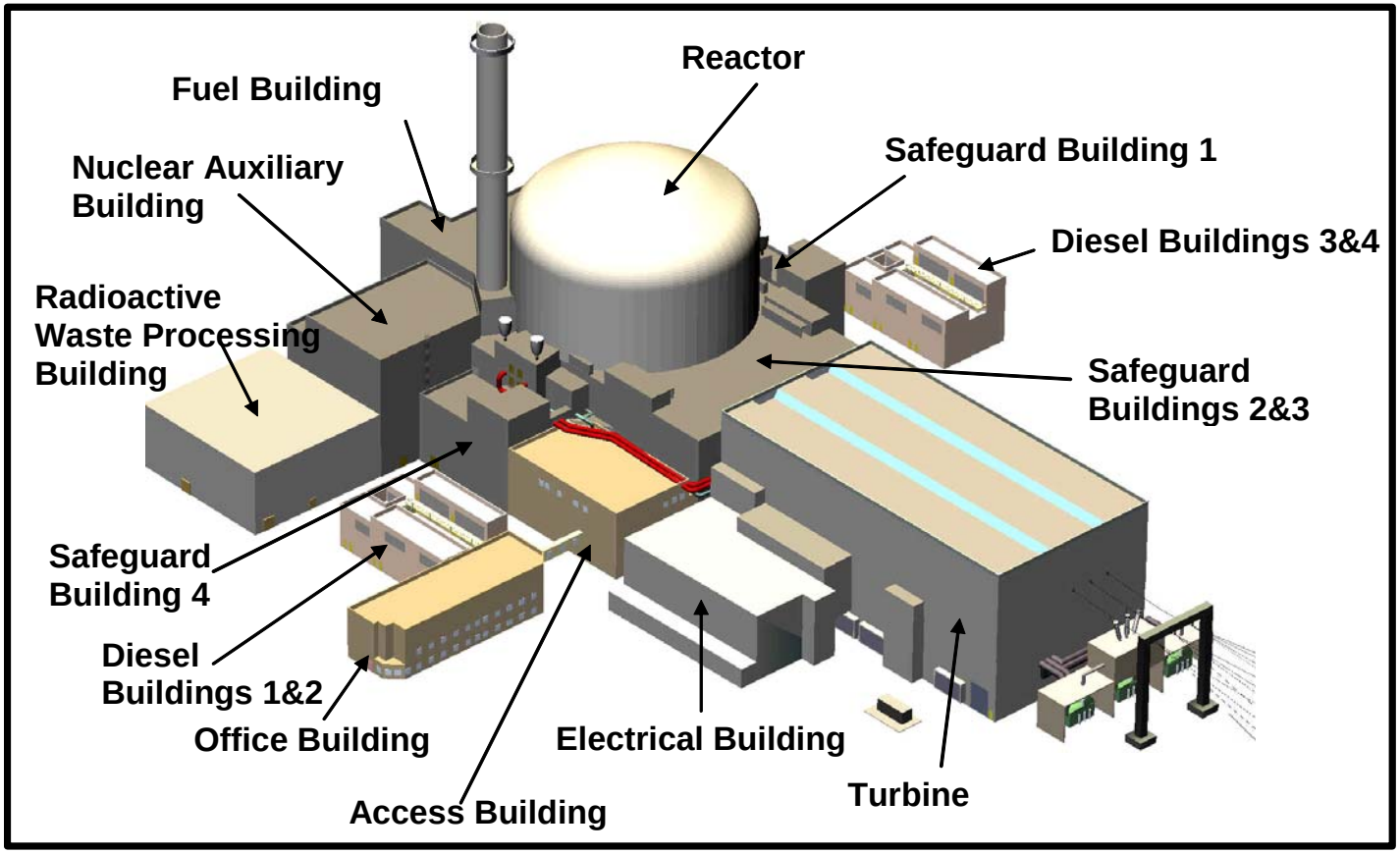
Flamanville, France

Taishan, China

Olkiluoto, Finland

- **Under licensing in the USA**

Layout of main EPR™ buildings



EPR™ design improvements: nuclear safety

- **EPR™ design combines best safety and environmental features of the previous N4 and Konvoi PWR designs**
  - Main Safety Systems consist of 4 identical 'trains' each able to carry out the required safety function and which are housed in separate concrete buildings for improved protection
  - Reactor located in double-wall concrete containment (prestressed concrete inner shell with a metallic liner and reinforced concrete outer shell). Inter-space kept at sub-atmospheric pressure to collect and filter minor leakages
  - Outer "aircraft shell" protects reactor and critical safety equipment against aircraft impact, explosion etc. Its design is adapted to withstand commercial aircraft impact post 9/11
- **New "Generation 3" safety features included in EPR™ design to prevent radioactivity being released to environment in event of severe accident challenges**

EPR™ design improvements: environmental impact

- Use of Best Available Techniques (BAT) to prevent and minimise the production of waste
- Improved thermal and nuclear efficiency result in reduced natural uranium usage per unit of electrical energy produced
- Higher fuel burnup results in reduced spent fuel volumes produced over reactor life
- Production of radioactive corrosion products minimised by optimised choice of reactor materials and coolant chemistry
- 60 year plant life results in reduced quantities of decommissioning material per unit of electrical energy produced

Radioactive discharges

Liquids

- **Sources: systems for treating primary circuit water and systems connected to the primary system**
- **Treatment**
  - Effluents are collected and treated so most radioactivity is retained on site
  - Facilities include tanks, filters, evaporation, ion exchange resin beds
- **Effluents are monitored and sampled before discharge**

Gases

- **Sources: degassing of the primary circuit water and ventilation of nuclear buildings**
- **Treatment**
  - Effluents are held in the treatment system when necessary to reduce radioactivity by natural decay
  - Filtered then released into the atmosphere via the stack
  - Facilities include high efficiency filters, delay beds, iodine traps
- **Stack discharges are monitored**

Dose to the adults for the critical group

	Liquid discharges	Gaseous discharges	Direct radiation	**TOTAL**
µSv/y	17	4	4.8	**25.8**

- **Dose can be compared with UK legal limit (1,000 µSv/y) and the dose constraint recommended by HPA for new build (150 µSv/y)**

Solid waste

- **Radioactive waste**
  - **Sources**
    - Spent ion exchange resins, spent filters, worn-out plant components, potentially contaminated protective clothing and tools
  - **Material is collected and treated in the solid waste treatment facility**
  - **Off-site disposal or on site storage used depending on type of waste**
- **Non radioactive waste**
  - **Produced from operating and maintaining the plant**
  - **Includes**
    - Combustion gases from emergency diesel generators
    - Water containing water-treatment chemicals
    - Waste oils

Potential GDA Issues raised by the EA - Decommissioning

- **UK EPR is designed to facilitate maintenance and decommissioning**
  - Selection of materials and operating conditions to reduce radioactivity and dose uptake
  - Plant layout and equipment design to improve access and ease of disassembly to reduce operation times
- **Our submission currently addresses:**
  - EPR™ Design features to facilitate decommissioning
  - Materials inventory
  - ILW disposability assessment
  - Outline decommissioning methodology and plans
- **Work to be completed within the GDA timeframe to develop more detailed UK EPR decommissioning case including:**
  - Development of decommissioning strategy
  - Detailed waste inventory and disposability requirements
  - Decommissioning methodology and processes
  - Hazards analysis
  - Implementation schedule

Potential GDA Issues raised by the EA – Disposability of spent fuel

- **On-site Interim Storage Facility (ISF) options based on proven technologies**
  - wet (pool) or dry (cask or vault)
  - ISF design life – 100 years from start of spent fuel interim storage (ISF refurbishment/replacement if extended on-site storage period required)
- **SF will be transported in casks from ISF to Encapsulation & Geological Disposal Facilities**
- **Resolution plans to be implemented by potential operators are being developed to address issues identified from GDA disposability assessment**
  - Integrity and monitoring of spent fuel for long interim storage period through on-going international R&D programmes and design substantiation studies
  - Definition of SFA disposal containerisation and disposal arrangements taking into account the fuels higher decay heat
- **NDA Radioactive Waste Management Directorate contracted by the Nuclear Industry Association on behalf of potential operators to undertake feasibility studies**
- **Work programmes reviewed by UK Regulators and likely to continue beyond first safety concrete for construction**

UK EPR website

http://www.epr-reactor.co.uk