

PLANT LIFE MANAGEMENT OF EDF PWR NUCLEAR FLEET



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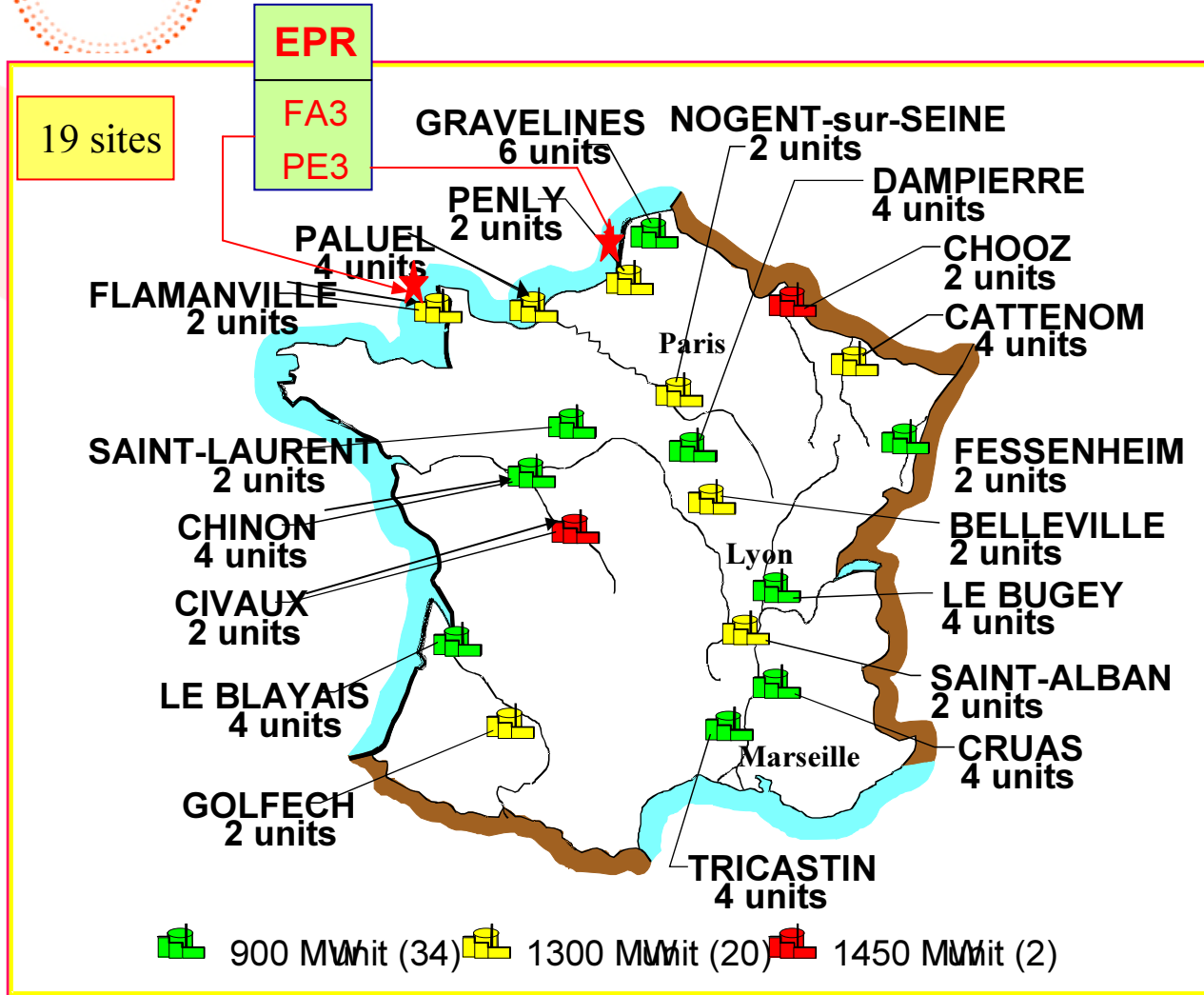


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Introduction

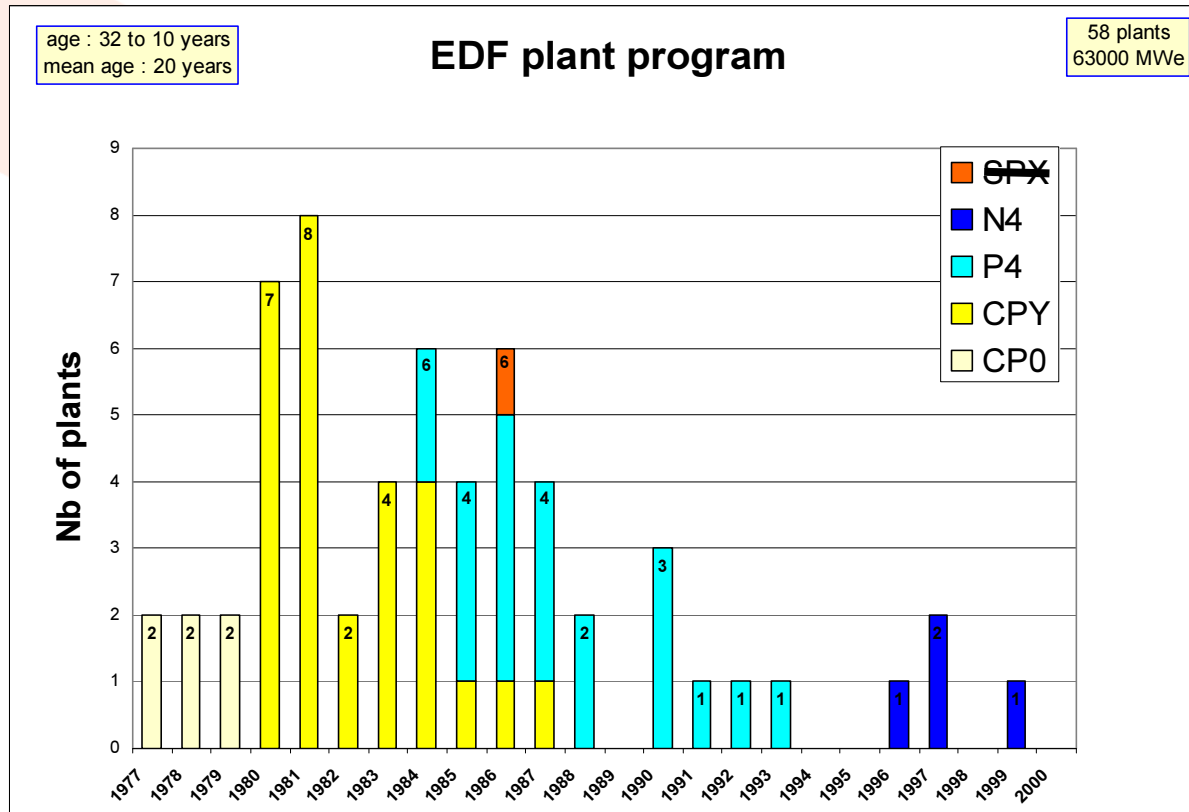


- 128 GW generation capacity
- production around 633 TWh, 607 TWh in Europe, 485 TWh in France.
- 9 reactors decommissioned (HWR, GGR or FBR),
- 58 similar PWR reactors in operation, on 19 sites, 63 GW
- 3 standardized levels :
 - * 900 MW – 3 loops, 34 plant units, 31 GW
 - * 1300 MW – 4 loops, 20 plant units, 26 GW
 - * 1500 MW – 4 loops, 4 plant units, 6 GW
- 2 EPR under construction





Service life of French NPP's



-mean age end of 2008
* 28Y for 3-loop 900MW
* 18Y for 4-loop 1300MW
- 1st 10Y shutdown
of N4 1500MW in 2009

Service life in the core of :
- national energy supply
- reliability and competitiveness
of the EDF production

Decision to build EPR-FA3, as a 1st of a serie, and PE3 decision, confirm the wish to maintain a real and competitive nuclear option





Service life challenges

◎ Service life is a challenge for EDF :

- Control and continuous improvement of Safety
- Adequate economic returns from the existing industrial asset
- Operation beyond 40 years to smooth new construction program (50GW/Y in the 80s)





Service life challenges

◎ Main questions on plant life management

- Initial design life is 40Y, beyond yardstick of compliance with safety requirements
- Improvement of safety :
 - continuously through operation and maintenance
 - on the 10Y basis through modification of installations
- Improvement operating performance
 - Optimized fuel management and increase flexibility
 - Reduce plant shutdown times and rate of unplanned scram
- Management of physical ageing of the plants (causes / consequences):
 - Dynamic and proactive ways
- Safety and Operation/ Maintenance on-site engineering and external industrials
- Greater public acceptance





Service life challenges

- ◎ The regulatory requirements in regard to the 3rd 10Y shutdown in 2009
 - Conformity analysis with 2007 to 2014 reference conditions
 - Re-assessment of safety 2003-2008
 - Justification of overall control of fitness for service and R&D actions 2008
 - Implementation of modifications and operation documents 2009-2017
 - Complementary analysis and decision plant by plant
- ◎ EDF answer to the challenge
 - Periodic safety review
 - Ageing management program review





Periodic Safety Review

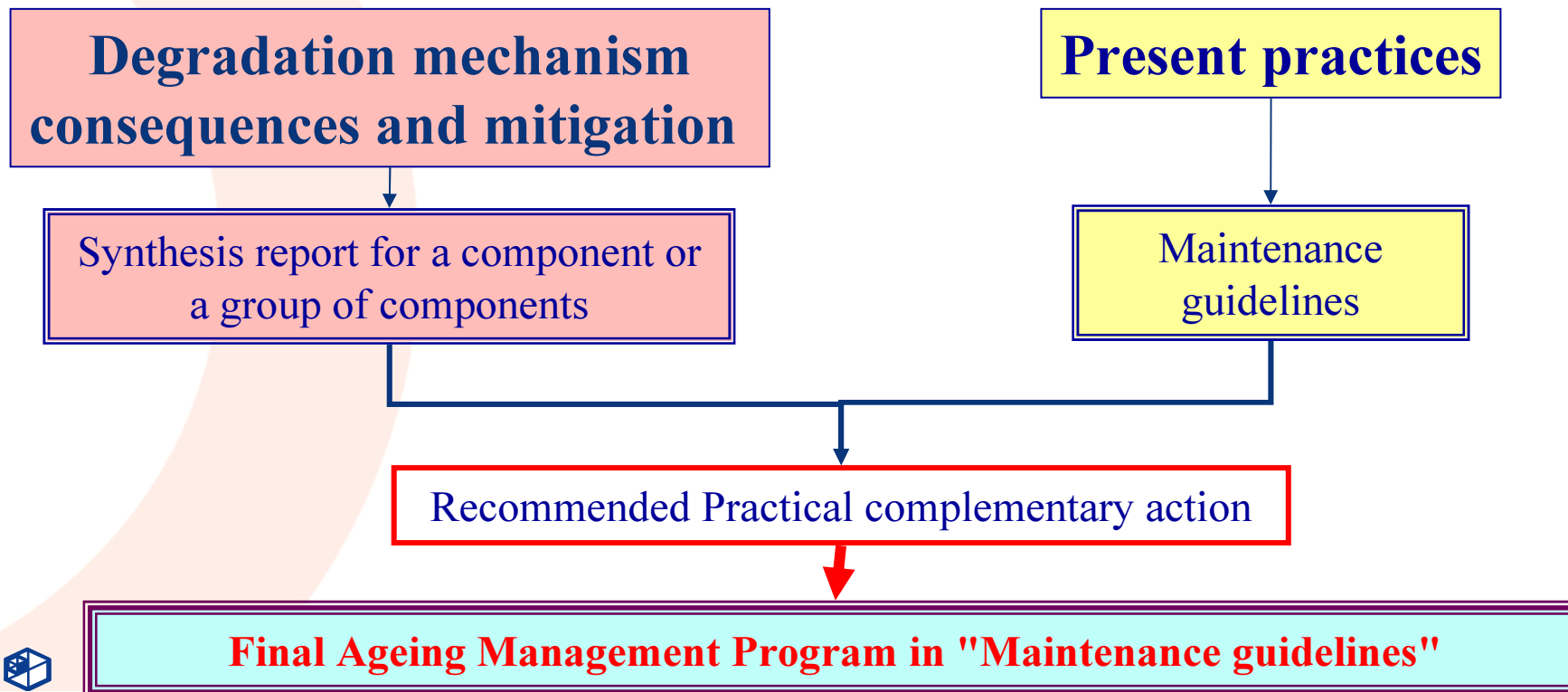
- ◎ Every 10Y for each plant, in accordance with the French regulation, include:
 - Requalification of the primary and secondary system :
 - hydrotest+inspection
 - Review of the initial stress report with updated information
 - Leak tightness test of the containment
 - All other reference safety requirements : rules, codes & standards...
 - To answer EDF develops :
 - Conformity inspection of each plants
 - A conformity inspection programme : inspection and preventive maintenance
 - A programme of additional investigations
 - Safety re-assessment, like : seismic, fire protection, severe accident...





Ageing management program

- ◎ Identification and characterization of encountered or potential degradation that can affect safety and competitiveness
- ◎ Optimization of maintenance, surveillance and inspection in regard of the existing programs and review conclusions





Ageing management program

- ◎ Systematic analysis of national and international field experience
 - Similar plant
 - Similar location
 - Similar problem
 - Consideration of "weak signal" for anticipation
- ◎ Obsolescence management for equipments and components
 - EDF needs and priority / Industry possibility and risk
 - Definition of case by case strategy
- ◎ Human resources internally and externally : specific project





Ageing management program

◎ Research and Development : dedicated program to ageing of component and structures to support this AMP in different direction, like:

- Material degradation : "Material Ageing Institut" for metallic and non-metallic material
- Component analysis and test
- Risk informed and probabilistic analysis
- ISI techniques

◎ International cooperation

- EPRI, PWROG, FROG, INPO
- IAEA, OCDE-NEA, EC
- Utility direct cooperation in USA, Japan, Germany...
- IAEA documents and GALL report have been integrated in our general process





EPR Design and Safety

- ◎ EPR Flamanville 3 (1600MW) includes many improvements connected to AMP
 - LER practically eliminate
 - Break exclusion of the main coolant line and the main steam line in the design basis
 - Low end of life radiation level (1/3 of existing plants)
 - No use of Alloy 600, 182, 82
 - High cycle thermal fatigue countermeasures
 - Radioprotection consideration included in the component design
- ◎ Consequently, Codes and Standards and EDF specifications have been improved to include major results of the AMP review





Conclusion

- ◎ EDF analysis confirm a minimum service life of 40 years for all the 3-loop plants, accepted by the French Safety Authority
- ◎ Continuous improvement of safety level is confirmed through the PSR and AMP review
- ◎ All this program is associated to an R&D support, an obsolescence project, a continuous analysis of the field experience and human resource project
- ◎ International cooperation is an important issue to this program
- ◎ Consequences for new plants and Codes & standard are strongly consider
- ◎ EDF has the objective to extend average lifetime of its NPPs over 40Y
- ◎ putting development of safety culture and skills, and continuous increase of safety level of plants, at the center of the industrial performance

