Considerations on the Reference Plant Concept

Claude MAYORAL AREVA NP

IAEA
International Conference on Topical Issues in Nuclear Installation Safety: Safety Demonstration of Advanced Water Cooled Nuclear Power Plants
Vienna 06-09 June 2017
Contents

- Historical background
- Tentative definition of the regulatory Reference Plant Concept
- Discussion of the impact of specific Reference Plant Concept requirements in a regulatory framework
- Conclusion
Use of the concept of reference plant

Main following objectives

- Get a guidance in the implementation of a nuclear project – use of the experience feedback of another nuclear project more advanced in time

- Get a reference in terms of safety concepts assessment by another Regulatory Body – confidence in the level of nuclear safety of a new nuclear project

- Minimize the risks of a nuclear project schedule using established plant designs (erection and manufacturing experience feedback)
Use of the concept of reference plant

Some limitations of the complete adherence to a reference plant

- Site specific conditions,
- Respect of national regulations,
- Utility specific requirements,
- Reference plant still a living project – necessary to adopt as a reference a coherent status of the project different from the reference plant "as built"
- New reactor design proposal based on one or several nuclear power plant models called “parent design”
Examples of the reference plant concept used in France for the national and exporting markets

Beaver Valley NPP

North Anna NPP (power uprate/Fessenheim NPP)

Fessenheim NPP

Bugey NPP

History Background

North Anna NPP (power uprate/Fessenheim NPP)

Bugey NPP

(copyright Fisrt Energy corporation)

(copyright AREVA Salomon Jean-Pierre)

(copyright DOMINION VIRGINIA POWER)

(copyright AREVA)
Historical Background

Examples of the reference plant concept used in France for the national and exporting markets

Tricastin NPP

Koeberg NPP

Flamanville 3 NPP

Civaux NPP N4 type

Neckar NPP Konvoi type

(copyright AREVA Joly, Emmanuel)

(copyright AREVA)

(copyright EDF Morin Alexis, Soubigou Antoine)

(copyright AREVA Pauquet, Claude)

(copyright AREVA)
To encourage new entrant countries to base their first construction on the concept of reference plant

- Same design and safety features (attention to be paid also to site characteristic potential differences)

- Design licensed by the Regulatory Body of the exporting country

- Knowledge transfer relationship with the exporting country Regulatory Body recommended

- Nevertheless, new entrant country Regulatory Body should pay attention to
  - Get a good understanding of the design
  - Design differences (site related parameters, plant layout, new design features based on operating experience and technology advancement)
Reference plant concept used for contractual purposes

Plant of a similar design / nuclear project to be built:

- Level of detailed design sufficient to secure the project and limit industrial risks,

- Experience of vendor and buyer and maturity of the proposed project

  important factors to limit industrial risks

- Precise list of contractual documents with a sufficient level of details in terms of content and scope
Reference plant concept used for regulatory purposes

- Plant of a similar design and safety features / nuclear project to be built:
  - Already licensed or certified in the vendor country or in another country.

- Helps securing the licensing process minimizing risks of dead ends during safety evaluation process.
  - A reactor design already gone through a thorough safety evaluation by an experienced Regulatory Body comfort feasibility of a similar design licensing process in a reasonable time frame

- Especially for new entrant countries, the Regulatory Body work facilitated/supported by
  - Existing Safety Evaluation Reports of the reference plant
  - Insights of various safety analyses already carried out for the reference plant

Tentative definitions
Reference plant concept used for regulatory purposes

- Concept of Reference plant could also be extended to:
  - A reference design at the level of a detailed design
    - with strong similarities with an existing model using:
      - Proven technologies,
      - Safety concepts already assessed by experienced Regulatory Bodies
Impact of specific conditions in the regulatory framework

- Up to now specific conditions related to the use of the reference plant concept in national regulatory frameworks is very seldom

- Some countries currently revising their regulatory framework requirements to allow for more flexibility

- Even if requirements in regulatory framework intend to bring more confidence about project safety and time completion it could lead to
  - Limit the number of potential adapted nuclear power plant models and associated vendors,
  - Intellectual properties issues (in case of a requirement asking for the transmission of the entire reference plant safety case)
Reference plant concept has proven its efficiency

- Knowledge transfer between Regulatory Bodies
- Eased licensing process through Regulatory Bodies collaboration

Nevertheless introducing requirements, if any, in the national regulatory framework

- Could lead to a lack of flexibility to choose well adapted reactor models to country specific requirements

Concept of Reference plant could be extended to a reference design at the level of a detailed design (with strong similarities with an existing model using proven technologies and safety concepts)
Thank you for your attention