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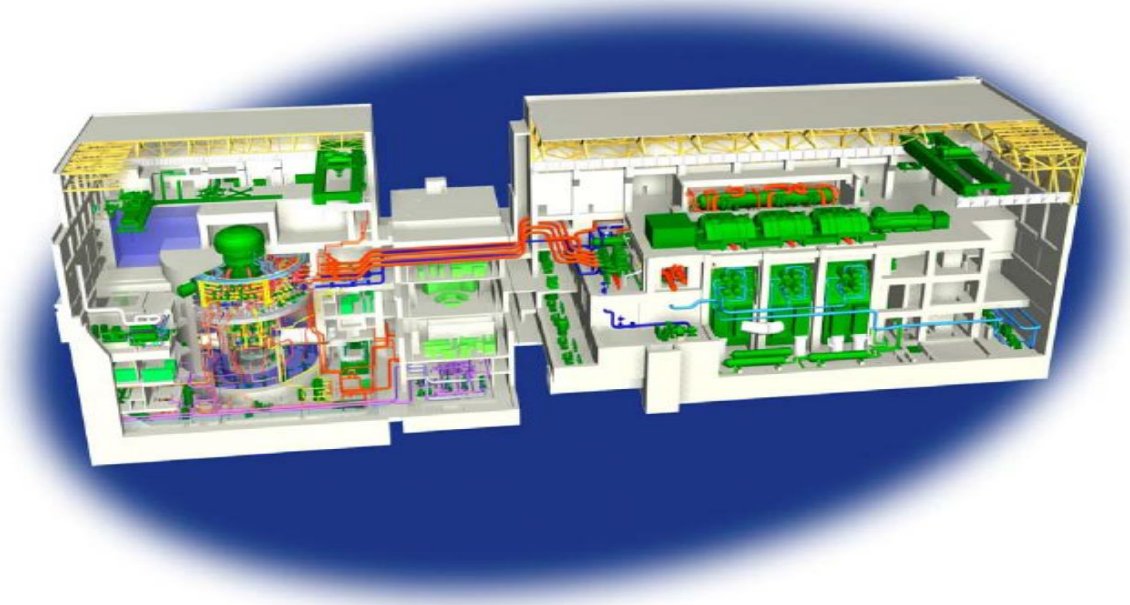
Toshiba ABWR
Design Certification Renewal



PRA, Hurricane, SC-I Structures May 22, 2012

Agenda

- Introductions and Opening Remarks
- Desired Outcomes
- PRA
- Hurricane Missiles
- Seismic Category I (SC-I) Structures
- Change Category Identification

Attendees

- Robert Schrauder, TANE, Licensing VP
- Dale Wuokko, TANE
- Yuya Aoyagi, TANE
- Robert Quinn, Westinghouse
- Vishu Visweswaran, Westinghouse
- Storm Kauffman, MPR
- Caroline Schlaseman, MPR
- Dan Stenger, Hogan-Lovells

Desired Outcomes

- NRC understands:
  - Toshiba's responses to NRC follow-up questions regarding PRA for the ABWR DC Renewal (DCR)
  - Toshiba's plans for addressing Hurricane Missiles (per RG 1.221) in DCR
  - Toshiba's plan for identifying change categories in DCR

- Toshiba understands NRC question about Seismic Category I Structures in DCR

PRA

PRA Background

- Toshiba submitted its application for ABWR Design Certification Renewal (DCR) on October 27, 2010.
- Toshiba performed a limited PRA Update to support DC Renewal.
- Toshiba met with NRC on June 23, 2011, to discuss preliminary NRC questions.
- Toshiba provided responses to NRC's 14 subsequent questions in Toshiba's letter dated September 12, 2011.
- NRC has requested additional discussion of responses to questions 3, 4, 5, 6, 9, 10, 12, 13, & 14.

Questions 3 & 5 – D-RAP Risk-Significant SSCs

- Q3: Should other SSCs be included in Appendix 19K Table 19K-4?

  A: Toshiba agrees that additional SSCs will be added to Table 19K-4 in the DC Renewal, but notes that the COL applicant is required to do this. Therefore, Toshiba does not plan to make major changes to Table 19K-4 in the DCR. See response to Q5 below.

- Q5: What are Toshiba's plans to supplement the PRA to determine SSCs to be included in the D-RAP?

  A: Consistent with DC/COL-ISG-018, Toshiba is expanding COL Item 17.3.13.1 which will require the COL applicant to update list of risk-significant SSCs (prior to detailed design and construction phases) by augmenting the PRA techniques using an expert panel, industry operating experience, and a deterministic technique that is based on defense-in-depth. Additionally, the expanded COL Item 17.3.13.1 will require the COL applicant to describe the methodology that will be used to supplement the PRA in determining the SSCs to be included in the D-RAP.

Question 4 – Low Power Shutdown (LPSD) PRA

- Q4: Was the list of risk-significant SSCs in Appendix 19K updated based on the results of the new LPSD PRA?

  A: Many risk-significant SSCs for LPSD are also significant for operating plant conditions and are already included in Appendix 19K. Due to the small LPSD CDF, which is about 1% of the Level 1 operational CDF, risk-significant contributors to LPSD CDF are negligible contributors to overall CDF.

  The COL item discussed for Question 5 includes expert panel (deterministic) evaluation of SSCs used for LPSD, and therefore the list of risk-significant SSCs in Appendix 19K will likely be revised by the expert panel review required by the expanded COL item.

Question 6 – Low Power Shutdown (LPSD) PRA Drain Down

- Q6: Why was BWR operational data not used to estimate the frequency of inadvertent RCS drain down events?

  A: The ABWR has many features intended to preclude or mitigate drain down events; existing BWR data was not considered directly applicable, and ABWR drain down data was not reported in available Japanese operating experience (from JNES).

  Examples of ABWR mitigating features for drain down from RHR include:

  - RHR suction valves F010 & F011 isolate at vessel Level 3
  - Boundary valve indications in Control Room
  - Interlocks or key locks on some valves

Question 6 cont'd – LPSD PRA Drain Down

For drain down via an interfacing system, diversion path screening was performed using the following criteria:

- Less than 2 Inches: CRD will be able to make up flow, preventing a disturbance in shutdown cooling operation.
- At least one locked valve: frequency of inadvertent valve opening or operator misaligning negligible. Typically there is a periodic walkdown to verify locked valve position.
- Pipe end has cap: Drain lines typically have one or two normally closed isolation valves. If also capped, consequence of valve failure or operator error is insignificant.
- Through three or more closed isolation valves: frequency insignificant.

7 of 16 paths screened out; remainder were explicitly assessed using the following approach.

Question 6 cont'd – LPSD PRA Drain Down

Approach:

- Flow diversion initiating event frequency (IEF) evaluated by fault tree for diversion paths (Table 19L-8)
- Flow diversion IEF input into MLOCA/LOCA event tree
- Customary human error probabilities (HEPs, e.g., manual valve mis-positioned & no flow indication=1E-4)
- Only automatic isolation modeled. Manual isolation not credited.

Results of limiting component unavailability case:

- Discussed in detail in Appendix 19 Section 19L.6
- LPSD CDF (all events) 1.77E-09/year
  - RHR flow diversion IEF 2.48E-4/year
  - CUW flow diversion IEF 1.40E-8/year
  - CDF of flow diversion in RHR System ~14.4% (of LPSD CDF)
  - CDF of flow diversion in CUW System <0.01% (below truncation)

Question 6 cont'd – LPSD PRA Drain Down

Additionally, future COL applicants are required by RG 1.206, C.I.19.4, to review relevant operating experience as part of the plant-specific PRA.

Question 9A – Seismic Margins Analysis (SMA)

- Q9A: Has Toshiba re-evaluated the plant-level high confidence of low probability of failure (HCLPF) capacity based on the accident sequences generated by the updated Internal Events PRA?

  NRC needs to understand why the new Level 1 PRA data would not impact the existing SMA. What is basis for the conclusion that SMA has no impact?

  A: Some changes have been made to the Level 1 PRA, e.g., Initiating Event Frequencies and Component Failure Rates. All but one of the changes have no potential impact on the SMA. Specifically, the site-specific ultimate heat sink (UHS) design has been considered in the new Level 1 PRA.

  For the SMA, the UHS design (along with the other site-specific SSCs) is required to be evaluated by the COL applicant via COL Item 19H.5.1, so it does not impact the standard plant SMA.

Question 9B – Seismic Margins Analysis

- Q9B: Have the accident sequences generated by the low power and shutdown models been included in the plant-level HCLPF capacity evaluation?

  Usually, an SMA for full power and for shutdown includes the same list of SSCs. Are there any differences in the cut sets for shutdown such that your insights would be different?

- A: Review of the LPSD PRA Cutsets was performed:
  - The top fifty cutsets from the ABWR LPSD PRA* were reviewed.
  - The SSCs in the cutsets were identified.
  - Operator actions and recovery actions are generally not considered in the SMA. However, the SSCs associated with those actions were identified.

  (*From Appendix E of UTLR-0013, “ABWR Shutdown Risk Evaluation”)

Question 9B cont'd – Seismic Margins Analysis

- The following SSCs were identified in the LPSD PRA cutsets:

  - •Offsite Power
  - •Combustion Turbine Generator
  - •RHR System
  - •Emergency Core Cooling System
  - •DC Battery
  - •Emergency Diesel Generators
  - •AC Independent Water Addition System
  - •High Pressure Core Flooder System
  - •Instrumentation System

- All of the above SSCs are modeled in the SMA with the following exceptions:
  - Offsite power (which is assumed lost following a major seismic event)
  - Combustion Turbine Generator (which is not seismically qualified)
  - Instrumentation system (which is judged to be seismically rugged, and therefore failures were not explicitly modeled)

Conclusions from the LPSD PRA Study: The LPSD PRA does not identify any new SSCs that would need to be considered in the SMA.

Question 10 – Internal Flooding

- Q10: Has Toshiba considered updating the internal flooding PRA? What are the insights from the internal flooding PRA?

  A: Toshiba considered updating the internal flooding PRA. Based on Toshiba's review, there are no current plans to revise the existing discussion on the internal flood PRA in the DCR.

  The internal flood PRA in the original DC PRA demonstrated CDF values significantly below the goal due to the three divisional design and significant built-in flood barriers that prevent most floods from affecting more than one division. The low CDF is also attributable to many features (Table 19R-7) included to prevent and mitigate floods in the plant.

Question 10 cont'd – Internal Flooding

The insights as noted in 19R.6.2 are:

- Due to its basic layout and safety design features, the ABWR is inherently capable of mitigating potential internal flooding. Design features include safety system redundancy and physical separation for flooding by large water sources along with alternate safe shutdown.
- Only a small number of flooding specific design features must be relied on to mitigate all potential flood sources.
- All postulated floods can be mitigated without taking credit for sump pumps.
- While timely operator action can limit potential impact, all postulated floods can be adequately mitigated (from a risk perspective) without operator action.

Question 12 – Conditional Containment Failure Probability (CCFP)

- Q12: Would Toshiba consider addressing the SECY-90-016 safety goal of conditional containment failure probability, without reliance on release via the Containment Overpressure Protection System (COPS)?

A: SECY-90-016 discussed the ABWR, noting

"GE has performed an analysis utilizing this definition of containment failure to determine if the ABWR meets the CCFP goal of 0.1. The analysis indicates that the CCFP for the ABWR design, without a vent system, is equal to approximately 0.5 and does not meet the 0.1 goal, however with a vent system, the CCFP equals approximately 0.06. Based upon the preliminary review of the ABWR severe accident design, the staff has determined that, as far as overall risk impact is concerned, the GE ABWR public safety goal is significantly more stringent than the Commission's quantitative health objectives. Also, the staff concludes that the public safety goal proposed by GE for the ABWR design is more stringent than the "large release guideline" as defined in the staff's proposed safety goal implementation plan. Therefore, **based on the apparent enhanced level of safety provided by the ABWR's severe accident design features, which include the over pressure protection system, the staff recommends the Commission approve its use in the ABWR design certification process** [emphasis added]."

Question 12 cont'd – CCFP

The SECY-90-016 Staff Requirements Memorandum (SRM) stated

> "The Commission (with all Commissioners agreeing) has approved the staff's recommended use of the containment overpressure protection system on the ABWR, subject to the results of the comprehensive regulatory review which should fully weigh the potential "downside" risks with the mitigation benefits of the system. Staff should ensure that full capability to maintain control over the venting process is provided."

Based on the SECY-90-016 and associated SRM discussion of ABWR CCFP and subsequent NRC design certification of the ABWR with reliance on COPS, Toshiba considers use of COPS is reasonable and acceptable to the NRC, and meets the NRC goals.

Question 12 cont'd – CCFP

Additionally:

- NRC Staff no longer proposes to use CCFP for the new reactor regulation, replacing it with Large Early Release Frequency.
- Recently ACRS has accepted the NRC Staff position in their April 12-14, 2012 meeting by concluding as follows:

> "We concur with the staff's recommendation of Option 2C for transition from use of the conditional containment failure probability (CCFP) and large release frequency (LRF) metrics to the use of only the large early release frequency (LERF) metric at or prior to initial fuel load."

Question 13 – Severe Accident Management Guidelines (SAMGs)

- Q13: Will Toshiba consider providing information to the BWROG regarding the role of the design's severe accident mitigation features (e.g., AC Independent Water Addition) in addressing long-term station blackout scenarios, and how this information might be used to improve Severe Accident Management Guidelines?

  A: The BWROG will be provided with severe accident response insights for the ABWR.

- Q14: Is Toshiba planning to use the state-of-the-art severe accident tools to compute realistic source terms in a SAMDA analysis? SAMDA is required for design certification applicants under 10 CFR 51.55. New and significant information regarding risk has been developed using the state-of-the-art tools mentioned above.

  A: SAMDA analysis conclusions would not change due to use of more modern accident assessment tools, since the very low CDF would still result in a negligible value for additional mitigation alternatives even if estimated source terms increased by two or three orders of magnitude.

Hurricane Missiles

Hurricane Missiles—Background

- ABWR DCD high wind and wind-generated missile loadings are based on RG 1.76, “Design Basis Tornado for Nuclear Power Plants,” Revision 0.
- RG 1.76, Rev. 0 requires evaluation of 300 mph straight plus 60 mph rotational wind speeds and corresponding tornado-generated missiles.
- The 300 mph based tornado-generated missiles will bound most sites in the U.S.
- NRC has requested that Toshiba consider the impact of newly issued RG 1.221 “Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants” on the ABWR DCR.

Hurricane Missiles—Planned Actions

- ABWR COL Applicants are required to evaluate site-specific natural phenomena, including high-wind events, to ensure they are bounded by the Standard Plant design requirements. Current COL Items include:
  - Tier 2, COL Item 3.5.4.2
  - Tier 2, COL Item 3.5.4.4 (which currently specifies only evaluation for Design Basis Tornado)
- NRC indicated they are planning a new ISG with guidance for how DC's should specify COL Item requirements related to hurricane missiles and RG 1.221
- Toshiba will review the ISG when it is issued and consider what changes, if any, should be made to the above COL Items

Seismic Category I Structures

Seismic Category I Structures

- The NRC has informed Toshiba/TANE that the NRC considers the Diesel Generator Fuel Oil (DGFO) Transfer Tunnels, which are Seismic Category I structures, to be in the ABWR standard plant scope.
  - The NRC noted that the tunnel design is not addressed or included in the certified ABWR standard plant design.
- Toshiba notes that a COL applicant will need to perform a site-specific design of these structures, as was done for STP 3&4.
- Therefore, Toshiba plans to add the DGFO Transfer Tunnels to the list of excluded SSCs (i.e., site-specific SSCs which must be designed by the COL applicant) in a future revision of the DCR.

Change Category Identification

Change Category Identification

- NRC draft guidance identifies “modification,” “amendment,” and “renewal backfit” as change categories for DC Renewals.
- During January 2011 public meeting, NRC requested that change categories be identified in Toshiba’s next DCD revision.
- Toshiba has identified all changes as either “modification,” “amendment,” or “AIA amendment.”
- Toshiba’s next DCD revision will include a new Tier 2 Appendix 1D which includes a summary listing of all changes and the applicable change category.