Technical Issues

October 9, 2008

Technical Issues

- Chi/Q Alternative Options
- TR-71B Follow Up – Startup Manual
- Human factor engineering
- Defense in Depth and Regulatory Treatment of Non-Safety systems
- Multiple Hot Shorts
- Fire Protection – Fire Hazard Analysis (NRC)
- Definition of “as built”

Chi/Q Alternative Options

Background

- **DCD Rev 16 incorporated a Decontamination Factor (DF) of 5 to calculate dose for containment release**
- **NRC notified WEC on August 14, 2008 that a DF of 5 would not be approved**
- **WEC submitted DCD Rev 17**
  - utilizing DF of 1 as approved in DCD Rev 15
  - incorporated design enhancements to the control room emergency habitability system
- **Resulted in a revision to the Chi/Q values presented in DCD Rev 17**

COLA Impacts

- **Control Room Dose**
  - COLA changes will be addressed in response to RAI
  - Preliminary evaluations have determined that all applicant Chi/Q values are bounded by the DCD values
- **Exclusion Area Boundary Dose**
  - The EAB Chi/Q values were determined using DCD Rev 15 methodology
  - COLA changes will be addressed in response to RAI
  - Preliminary evaluations have determined that most applicant Chi/Q values are bounded by the DCD values for EAB

BLN EAB Chi / Q Exceedance

- Westinghouse / Industry SMEs initiated workshop - September 2008
- Results identified analytical and design solutions
- Solutions evaluated and rated (regulatory, design, and standardization impacts)
- Preferred option to update analysis to reduce uncertainty

BLN Selected Option

- **Potential enhancements to analysis**
  - Re-evaluate source term
  - Re-evaluate containment leakage assumption
- **Scheduled to be complete within 90 days**

Upcoming Activities (Near Term)

- **Complete evaluation of analytical solution path**
- **Implement plan**
- **NRC meeting to discuss details (tentative October 27)**
  - Present preliminary sensitivity study

TR-71B Follow Up – Startup Manual

Conduct of Test Program

Startup Administration Manual

- APP-GW-GLR-038 (TR-71B), Conduct of Test Program, was submitted by Westinghouse to close COL Information Item 14.4-3, “Conduct of Test Program”
- DCD RAIs have resulted in establishing COL Holder Item 14.4-3 in DCD Rev 17, which replaces the original COL Information Item
- BLN will revise the COL Application to include the COL Holder Item and License Condition
- BLN has provided responses to R-COLA RAIs related to conduct of test program and anticipates these issues will be resolved through the implementation of DCD Rev 17 in the COLA

Human Factor Engineering

Human Factors Engineering

- **HFE RAIs have been issued related to DCD Rev 16 and BLN COLA**
- **BLN or WEC have provided responses with the exception of DCD RAIs #8 and 9**
- **Recent development based on NRC/WEC phone call:**
  - Path Forward for RAI #8
    - Acceptance of WEC plans with no further documentations needed for WEC RAI #8

Human Factors Engineering, Cont.'d

- Path Forward for RAI #9
  - Acceptance of COL item 18.2-1 closure
  - Acceptance of COL Item 18.7-1 closure at the same time as ITAAC, pending internal discussion with PRA branch
  - Closure of COL Item 18.5-1, ITAAC design commitment #2, with OSA-2 carried as an open item
  - Understanding that COL Item 18.11-1 can be deleted; however, Plant HFE/HSI "as designed at the time of plant startup verification" may become an ITAAC item (required for each plant)
- NRC to review WEC documentation (October 06-17) in support of RAIs #8 and #9
- BLN has provided responses to R-COLA RAIs related to HFE including TSC/EOF HFE and anticipates these issues will be resolved through the implementation of DCD Rev 17 in the COLA

Defense in Depth and Regulatory Treatment of Non-Safety Systems in AP1000

Background

- Nuclear plants with passive safety systems do not rely on active systems
- Active systems in the AP1000 design have defense in depth functions that act to keep passive safety related systems from being utilized

AP600 RTNSS Review

- The possible need for regulatory treatment of defense in depth systems and other non safety systems was addressed in the review of AP600
- Probabilistic assessments and deterministic requirements were considered in the review of these non-safety systems
- This review resulted in the identification of a limited set of short term availability controls such as requirements prior to entry of reduced inventory conditions

AP1000 Design Certification Review

- The AP1000 review and design certification confirmed the approach developed for the AP600
- ITAAC are included to confirm the installation of these systems

AP1000 Approach to RTNSS

- **WCAP-15985, Revision 2, "AP1000 Implementation of the Regulatory Treatment of Nonsafety-Related Systems Process," describes the implementation of the RTNSS process for the AP1000**
- **Results from the PRA support the conclusions of WCAP-15985**
- **The AP1000 FSER includes in Chapter 22 a good summary and discussion of RTNSS**

RTNSS and Defense in Depth

- **The AP1000 Design Certification defined a screening process for identifying RTNSS SSCs**
  - First step defined Defense in Depth functions and used PRA insights to then identify the RTNSS SSCs
  - This applied to the entire design, including support systems and consideration of site interface functions
- **Appropriate regulatory oversight was applied and identified in the DCD for SSCs that met the screening criteria**
  - These SSCs are identified in DCD Table 3.2-3
- **There are four possibilities for regulatory oversight of these SSCs**
  - See WCAP-15985 Rev 2, DCD Section 3.2, DCD Section 16.3, DCD Section 17.4, and FSER Chpt. 22

Conclusions

- **The regulatory oversight required for AP1000 nonsafety-related systems is covered by design finality**

Multiple Hot Shorts

AP1000 Design Certification

- **AP1000 design is qualified for single spurious actuation (FSER 9.5.1.5.c)**

- **Qualification for multiple spurious actuation is beyond licensing finalization. This is a new requirement**

SECY-08-0093

- "Because new reactor designs are integrating fire protection requirements, including the protection of safe-shutdown capability, into the planning and design phase for the plant, the potential for fire induced circuit failures and multiple spurious actuations to adversely affect the ability to shutdown is significantly reduced. Examples of design features that significantly reduce the adverse effects of fire induced circuit failures include the use of fiber optic cabling and separation of redundant trains by passive barriers in all new reactor designs and the passive shutdown systems of some new reactors"

AP1000 Design

- **AP1000 has designed the hazard out from the beginning**
  - Passive safety systems
    - No spurious actuation of a non-safety system would defeat the passive safety systems (FSER 9.5.1.5.c)
  - 4 independent, electrically-isolated safety divisions in separate fire areas
    - No spurious actuation of a single division of a safety system would defeat the passive safety systems
  - Redundant safe shutdown components
    - Actuated by separate safety trains
  - Use of I&C Voting Logic

Safety Divisions

- **4 independent, physically separated, electrically-isolated safety divisions**
  - These safety divisions do not share fire areas
  - Only one safety division could be subject to MSO at a time since they are routed through separate fire areas
  - No spurious actuation of a single division of a safety system would defeat the passive safety systems
- **No matter what spurious actuations of equipment occur in a single safety division, the remaining 3 divisions are sufficient to permit safe shutdown**

Redundancy - Example

- **Containment Isolation Valves**
  - Inboard and Outboard isolation valves are assigned different safety divisions
  - If every safety division A containment isolation valve spuriously actuates, division D maintains containment isolation

SYSTEM	PENETRATION	VALVE	POWER SUPPLY	TYPE	ACTUATOR	Location
CVS	Letdown	CVS-PL-V047	D	Globe	Air	ORC
		CVS-PL-V045	A	Globe	Air	IRC
	Charging	CVS-PL-V090	D	Gate	Motor	ORC
		CVS-PL-V091	A	Gate	Motor	IRC

I&C Logic - Example

- **Reactor Trip**
  - No matter what safety division spuriously actuates, 2/4 logic is required

From AP1000 DCD Table 7.2-2

Reactor Trip [1]	No. of Channels	Division Trip Logic	Bypass Logic
Power Range High Neutron Flux (Low Setpoint) Trip	4	2/4	Yes[2]
Overtemperature ΔT	4 (2/loop)	2/4	Yes[2]
Pressurizer High Pressure Trip	4	2/4	Yes[2]
Automatic Depressurization System Actuation	4	2/4	Yes[2]
Automatic Core Makeup Tank Injection	4	2/4	Yes[2]

1 Reactor Trip divisions are also bypassed with the logic as defined in 2. below.

2 Bypass Logic = 2/4 with no bypasses; 2/3 with 1 bypass; more than one bypass is not allowed.

Summary

- **Design is certified**
  - spurious actuation on a functional level was evaluated
  - meets separation requirements
    - Fire areas are separated by 3-hr structural barriers
- **Design is safe**
- **Design configuration control is maintained**

Tier 1 Definition of “as built”

Tier 1 As-Built Definition Changes

- Westinghouse has changed AP1000 DCD Tier 1 as-built definition
- Definition adopted the definition in NEI-08-01
- Definition provides for completion of ITAAC activities away from the final installed location
- Definition change included in AP1000 DCD Rev 17

NRC RAI-SRP14.3-NWE2-01

- NRC asked why definition should not be more restrictive
- Referenced NEI-08-01 Section 3.1.4
- Westinghouse response says that additional restrictions could have unintended negative effect
- Preferred approach is to use guidance document
- This issue is potential SER open item

Resolution

- As-built definition needs to be common to all design centers
- NRC endorsement of NEI-08-01 is the preferred path to resolution

AP1000 Design-Centered Working Group

Bellefonte 3&4 *Lee Nuclear 1&2* *Summer 2&3* *Vogtle 3&4* *Harris 2&3* *Levy 1&2*