NRC MEETING
AST POST SUBMITTAL

1. Opening Remarks – Doug Coleman

2. Issues Resolved and How – John Arbuckle
   a. Secondary Containment Drawdown
   b. Control Room Unfiltered Inleakage

3. Technical Specification Changes – John Arbuckle

4. Technical Approach – Bruce Boyum
    a. Issues Deferred (Simplified Approach)
    b. LOCA
    c. MSLB
    d. CRDA
    e. FHA
5. Discussion of NRC Comments – Jack Cushing
6. Implementation Schedule – Bruce Boyum
7. Concluding Remarks
    a. Energy Northwest – Rod Webring
    b. NRC

Secondary Containment Drawdown

- Could Not Develop 0.25-inch Negative Differential Pressure Within 120 Seconds Under Certain Post-Accident Meteorological Conditions (JCO Issued by NRC)
- Resolved by AST Analysis and Proposed Technical Specification (TS) Changes
- Secondary Containment not Credited for First 10 minutes in AST Analysis (leakage directly to environment and building X/Q used)
- Proposed Secondary Containment and Standby Gas Treatment TS Changes Ensure Secondary Containment Drawdown is Within Assumptions of Safety Analysis.

Control Room Unfiltered Inleakage

- Tracer Gas Testing Showed Maximum Combined Train Measured Unfiltered Inleakage (plus measurement uncertainty) for Control Room Emergency Filtration System was 218 cfm

- Results in Excess of Licensing and Design Basis Limit of 10.55 cfm

- Resolved by AST Analysis

- Based upon AST Analysis, Inleakage Rates in Excess of 218 cfm (up to 250 cfm) Result in Control Room Doses Below New Regulatory Reference Values

Technical Specification Changes

SR 3.6.1.3.10	Increase Secondary Containment Bypass Leakage Limit from 0.74 scfh to 0.04%/Day (~14 scfh)
3.6.1.8	Delete Main Steam Leakage Control System
LCO 3.6.4.1	Delete Secondary Containment Applicability During Movement of Irradiated Fuel and Core Alterations
SR 3.6.4.1.1	Change Requirement to Verify Every 24 Hours Pressure Within Secondary Containment is >0 Inch (v.s. 0.25 inch) Of Vacuum Water Gauge

Technical Specification Changes

SR 3.6.4.1.4 Delete Secondary Containment Drawdown Surveillance

SR 3.6.4.1.5 Change Requirement for Each Standby Gas Treatment Subsystem to Maintain ≥0.25 Inch Vacuum Water Gauge in Secondary Containment at *an Inleakage* Flow Rate of ≤ 2240 cfm

LCO 3.6.4.2 Delete Secondary Containment Isolation Valve Applicability During Movement of Irradiated Fuel and Core Alterations

Technical Specification Changes

LCO 3.6.4.3 Delete Standby Gas Treatment System Applicability During Movement of Irradiated Fuel and Core Alterations

SR 3.6.4.3.3 Change Requirement to Verify Each Standby Gas Treatment Subsystem Actuates on Initiation Signal *and Reaches $\geq$ 5000 cfm in $\leq$ 2 Minutes*

5.5.7 Increase Standby Gas Treatment System Flow Rates From 4012 - 4902 cfm to 4500 - 5000 cfm

AST SIMPLIFIED ANALYSIS APPROACH

1. All accident analyses except MSLB conform to Reg Guide 1.183

2. MSLB analysis utilizes a buoyant bubble model not addressed by Reg Guide 1.183

3. LOCA technical approaches that were deferred:
   a. Suppression Pool Scrubbing
   b. Aerosol Impaction
   c. Enhanced Drywell Spray Credit
   d. Enhanced Steam Line Deposition Credit
   e. MAAP Containment Thermal-Hydraulic Analysis
   f. Reduced ESF Iodine Release

AST ANALYSIS PEER REVIEW

1. Participants:
   a. Greg Broadbent, Grand Gulf – AST BWR Owners Group Chairman
   b. Brad Ferrell, Perry – AST BWR Pilot Plant
   c. Brad Harvey, Duke Engineering – X/Q Expertise

2. Peer Review at Columbia Generating Station for 1 week

3. Peer Review findings and observations have been incorporated or addressed

DOSE RESULTS
(REM TEDE)

ACCIDENT	CR	EAB	LPZ
DOSE LIMIT	5.0	25	25
LOCA	4.39	2.32	2.97
MSLB	0.28	0.71	0.20
DOSE LIMIT	5.0	6.3	6.3
CRDA	0.655	0.022	0.023
FHA	1.37	1.01	0.28

MAJOR ASSUMPTIONS
LOCA ANALYSIS

1. Conforms to Reg Guide 1.183.

2. **Source Term** per NUREG/CR-4691 with minor changes to better model release. Includes 66 isotopes total.

3. **Release Fractions** per RG 1.183, Table 1

4. Main Steam Leakage Control system not credited

5. **Drywell spray removal** credit per SRP model (analyzed per Appendix A, Sec 3.3 of RG 1.183)

6. **Natural deposition** in containment not credited

7. **Leakage pathways:**
   a. **Containment leakage** of 0.50%/day for first 24 hours
   b. **MSIV leakage** of 11.5 scfh per line, **deposition** between intact MSIV's only
   c. **Secondary containment bypass leakage** of .04%/day
   d. **Leakage from containment** assumed to reduce by 50% after 24 hours in accordance with Appendix A, Sec 3.7 of RG 1.183.
   e. **ESF leakage** 2 gpm, which is twice plant leakage (per Appendix A, Sec 5.2 of RG 1.183). An **iodine release fraction** of 10 % was used in accordance with Sec 5.5 of RG 1.183.

8. **Secondary containment drawdown** time of 10 minutes (analyzed per Appendix A, Sec 4.3 of RG 1.183)

9. **SGTS flow** of 5000 cfm, with 50 cfm filter bypass

10. **Secondary containment mixing** of 40% (within guidance of Appendix A, Sec 4.4 of RG 1.183)

11. **Control room emergency filters**:
    a. 95% efficiency for iodine
    b. 99% efficiency for particulates
    c. 1000 cfm +/- 10% per train (2 trains)
    d. 125 cfm unfiltered makeup per train (2 trains) – per tracer gas testing
    e. Reduce to one train after 30 minutes → operator action after 30 minutes IOCR

12. RADTRAD used to verify STARDOSE results results within 5%

13. AST Control Room X/Q calculations results and comparison with current FSAR values

	Secondary Containment		SGT Roofline	
	New AST Results	Current FSAR	New AST Results	Current FSAR
0 – 0.5 hr	4.13E-4	2.17E-4	2.41E-4	3.77E-4
0.5 – 2 hrs	4.03E-4		2.29E-4	
2 – 3 hrs	1.70E-4	5.43E-5	9.47E-5	9.43E-5
3 – 8 hrs		4.49E-5		7.80E-5
8 – 24 hrs	8.21E-5	3.55E-5	5.17E-5	6.17E-5
1 – 4 d	5.77E-5	1.67E-5	3.97E-5	2.90E-5
4 – 30 d	4.87E-5		3.05E-5	

14. AST Offsite X/Q calculations results and comparison with current FSAR values

	EAB		LPZ	
	New AST Results	Current FSAR	New AST Results	Current FSAR
0 – 2 hr	**1.8E-4**	**2.62E-4**		
0 – 8 hrs			5.04E-5	4.47E-5
8 – 24 hrs			3.76E-5	2.91E-5
1 – 4 d			1.99E-5	1.14E-5
4 – 30 d			7.97E-6	2.97E-6

MAJOR ASSUMPTIONS
CONTROL ROD DROP ACCIDENT

1. Conforms to Reg Guide 1.183

2. Fuel damage equals 1.79% of the core

3. Fuel melting occurs in .0138% of the core

4. Release fraction is:
   a. 100% noble gas and 50% iodine from melted fuel (per Appendix C, Sec 1 of RG 1.183)
   b. fraction of core inventory in the fuel gap is per Section 3.2 of RG 1.183

5. Activity reaching the condenser (per Appendix C, Sec 3.3 of RG 1.183):
    a. 100% noble gas
    b. 10% iodine
    c. 1% other
6. Condenser activity available to leak to environment (per Appendix C, Sec 3.4 of RG 1.183):
    a. 100% noble gas
    b. 10% iodine
    c. 1% other
7. Condenser leakage of 1%/day for 24 hours (per Appendix C, Sec 3.4 of RG 1.183)

8. Iodine released from condenser in form of (per Appendix C, Sec 3.6 of RG 1.183):
   a. 97% elemental iodine
   b. 3% organic iodine

9. Control room emergency filtration system is assumed to not start and control room not to isolate during this accident

10. Dose calculated for 30 days

11. Control room dose is 0.655R TEDE

MAJOR ASSUMPTIONS
FUEL HANDLING ACCIDENT

1. Conforms to Reg Guide 1.183

2. SGTS and Secondary Containment not credited for FHA

3. 24 hours fuel decay prior to accident

4. Release to the environment occurs over 2 hour period (per Appendix B, Sec 4.1 of RG 1.183)

5. Dose calculated for 30 day period

6. Fuel Damage is 0.528% of the core.

7. Iodine released from pool is 57% elemental and 43% organic (per Appendix B, Sec 2 of RG 1.183).

8. Control room emergency filtration system flow is 1800 cfm for first 30 minutes then 900 cfm. The corresponding unfiltered in leakage is 300 cfm then 150 cfm after 30 minutes. — inconsistent with handbook

9. Control Room dose is 1.37R TEDE

MAJOR ASSUMPTIONS
MAIN STEAM LINE BREAK

1. Activity available for release based on design basis coolant (.2uCi/gm) prior to break increased by factor of 20 for iodine spiking (4uCi/gm).

2. Control room isolation and emergency filtration system initiation not credited.

3. MSIV closure time assumed as 6 seconds (>Tech Spec limit).

4. All activity partitions with the steam and is well mixed throughout the bubble.

5. Design case:
    a. Direct ground release to environment
    b. Buoyant bubble rises and entrains air
    c. Calculated dose is within limits

6. Turbine Building (TGB) brief confinement case:

    a. Release overpressurizes TGB and vents to environment after brief delay
    b. TGB release is mixed with 50% TGB volume
    c. Buoyant bubble provides dilution due to plume rise with minimal air entrainment
    d. Calculated dose is within limits

7. Turbine Building traps steam bubble case:

    a. TGB remains intact and traps steam bubble
    b. Release from TGB over a 2 hour period
    c. Control room emergency filtration initiates after 30 minutes
    d. Calculated dose is within limits

AST IMPLEMENTATION

1. Remaining Engineering Work:
   a. FSAR/ LCS Changes
   b. Procedure Changes
   c. Design Requirement Document Changes
   d. MSLC Disable and Deactivate Design Changes
   e. EOP/SAG Guideline Changes
   f. Updating Design Calculations, Tech Memos, etc
   g. Design Change Package

2. Receive NRC SER

3. Implementation of design and Technical Specification changes to be determined – subject for discussion