

William States Lee III Nuclear Station





Plant Relocation Submittal Overview February 7, 2013

Purpose of Meeting



- Summarize and discuss December 20, 2012 Lee
 Plant Relocation Submittal
- Agenda
 - Introduction Bob Kitchen
 - Impacted FSAR Content John Thrasher
 - Non-Impacted FSAR Content John Thrasher
 - Preliminary Geotechnical and Structural Assessment John McConaghy
 - Wrap-up Bob Kitchen

Introduction



Challenge of Original Plant Location

- Site investigations and construction planning have identified:
 - The top of continuous rock on NW corner of Unit 1 may be deeper than anticipated
 - Represents increased risks to construction activities
- Potential construction impacts
 - Excavation requirements may be more extensive and deeper than planned
 - Groundwater level at excavation might have to be lowered as much as 130 ft below normal static level
 - Significantly more fill could be required
 - Significant potential construction costs and schedule impacts



Plant Relocation Impacts

- Licensing impact scope:
 - Geotechnical and Seismic
 - Hydrology Flooding and Groundwater
 - Meteorological
 - Routine Dose
 - Environmental
 - Security
- Re-evaluations demonstrate location change does not result in significant impact



Plant Relocation Licensing Impact Summary

- Changes identified in FSAR Chapters 1, 2, 3, 8, 11, 12, and 19
- Chapters 4, 5, 6, 7, 9, 10, 13, 14, 15, 16, 17, and 18 unaffected
- Overview on chapter-by-chapter basis



Lee COLA Challenge – Plant Location

- Relocation of Units 1 and 2 to mitigate future risks
- Relocate Unit 1 so that NW corner of Nuclear Island is over Cherokee foundation
 - Shift Unit 1 66 Feet South, 50 Feet East
 - Shift Unit 2 66 Feet South
- In addition, an increase in plant elevation provides flooding margin
 - Raise Plant Grade 3 Feet
- Smooth yard grade contours to provide flooding runoff
 - Yard grade inside Vehicle Barrier System ranges from 592 ft. to 590 ft.
 - Yard grade outside Vehicle Barrier System is 588 ft.

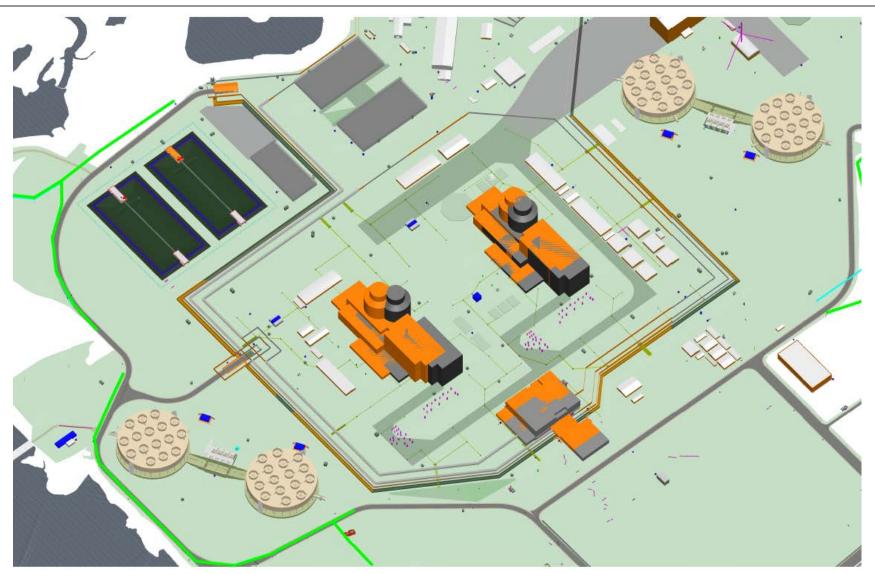
Unit 1 Plant Location Change





Revised Site Layout Comparison





Impacted FSAR Content



- Impacted FSAR Chapters and Sections
 - Chapter 1
 - Chapter 2
 - > Section 2.0
 - Section 2.1
 - > Section 2.3
 - > Section 2.4
 - Section 2.5 (See Preliminary Geotechnical & Structural Assessment)
 - Chapter 3 (See Preliminary Geotechnical & Structural Assessment)
 - Chapter 8
 - Chapter 11
 - Chapter 12
 - Chapter 19



Summary of Changes

- Figure 1.1-201 Site Layout reflects nuclear island relocation
- Description of elevation changes
 - Plant-specific grade elevation raised from 590 to 593 ft.
- Conforming change to remove Appendix 2CC from Table 1.8-202 COL Item Tabulation

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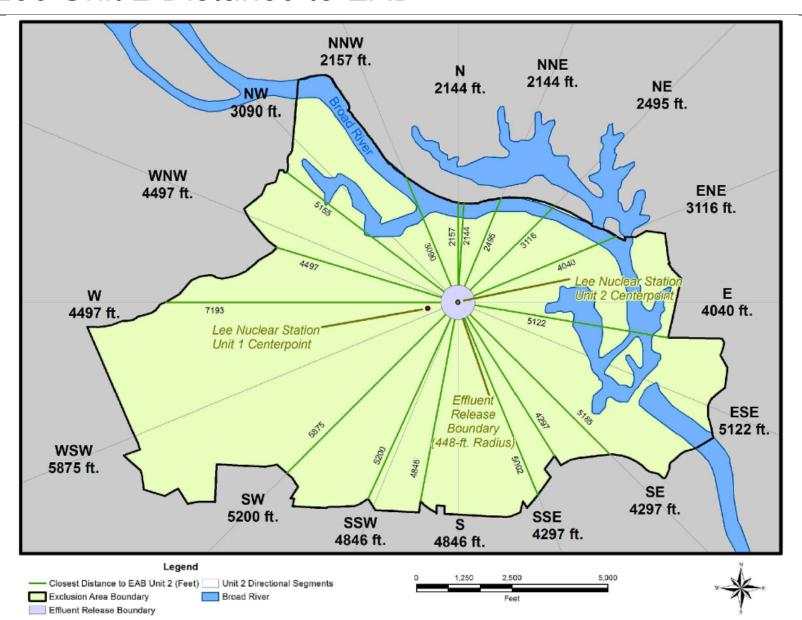
FSAR Chapter 2, Sections 2.0 & 2.1

Exclusion Area Boundary (EAB)

- Limiting Distance to EAB
 - Atmospheric dispersion analyses uses distances to the EAB from each unit
 - Previously used the center point between Units 1 and 2.
 - Unit 2 does not meet the AP1000 DCD, 0.5 mile minimum distance parameter to the EAB.
 - > 48 ft. short of the 0.5 mile minimum distance
 - Issue will be resolved prior to COLA update
 - Unit 1 and Unit 2 X/Q values remain below the site parameter values listed in the AP1000 DCD.

Lee Unit 2 Distance to EAB





FSAR Chapter 2, Section 2.3



Meteorological Impacts

- Updated Atmospheric Dispersion Analysis
 - Two years of meteorological data is used in the updated analysis
 - FSAR Appendix 2CC, which provided justification of the use of a 1-year data set, is removed.
 - Lee site values at current Exclusion Area Boundary (EAB) are below the AP1000 DCD site parameters
 - Technical Support Center (TSC) X/Q values updated with new distances and directions.

FSAR Chapter 2, Section 2.4



Hydrology Impacts – Flooding

Site Grading Changes

- Site defined by wide flat areas instead of having drainage swales.
- Site analysis updated based on new plant location and reconfiguration of site grading contours.

Maximum Site Flood Elevation

- Results from Probable Maximum Precipitation (PMP) event
- Maximum flood elevation is 592.56 ft. (less than plant elevation of 593 ft.)
- Site flood margin increase of 0.03 ft.



FSAR Chapter 2, Section 2.4 (Cont'd)

Hydrology Impacts – Flooding

- Surface Water Features
 - Flood level from surface water features remain below plant grade elevation (elev. 593 ft.).
 - Flood level associated with Make-Up Pond B (MUPB) remains maximum flood level associated with surface water features.
 - MUPB maximum flood level is 589.01 ft.
 - Increased wind wave runup elevation due to changes in site grading near MUPB

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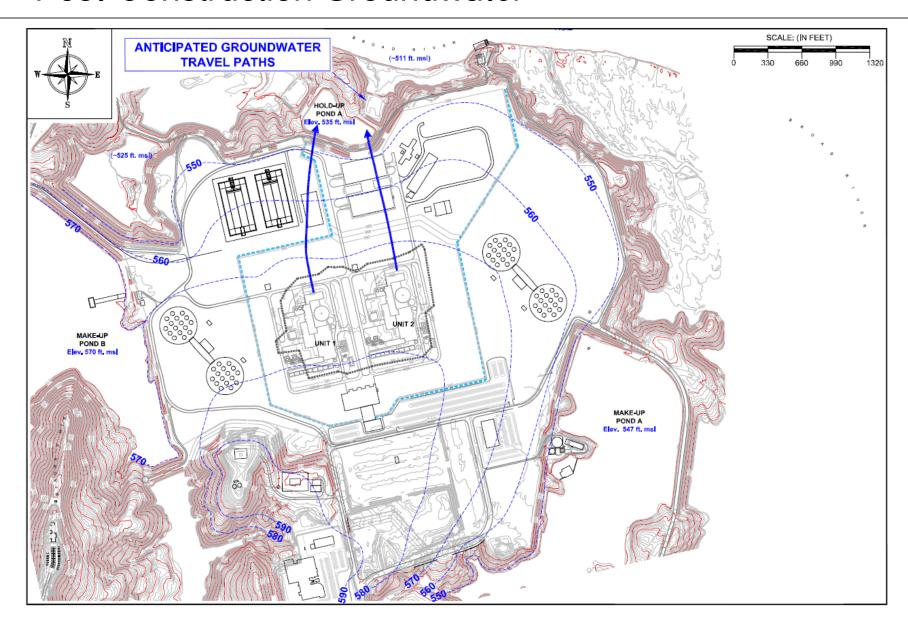
FSAR Chapter 2, Section 2.4 (Cont'd)

Hydrology Impacts – Groundwater

- Maximum Groundwater Level
 - Groundwater levels in the Power Block are slightly higher due to the southward relocation of Units 1 and 2, and the decrease of hardscape material along the east side of the Unit 2 power block.
 - Maximum level estimated to be approximately 584 ft. (less than the AP1000 DCD Site Parameter of 591 ft.)
- Groundwater Pathways and Accidental Release of Radioactive Liquid Effluents
 - One groundwater travel pathway removed due to changes in site grading.
 - Limiting pathway remains from Unit 2 to Hold-Up Pond A.
 - Requirements of 10 CFR 20.1301 and 10 CFR 20.1302 are still met.

Post-Construction Groundwater





FSAR Chapter 2, Appendix 2AA



Geotechnical Boring Logs

- Seven Borings
 - Additional borings performed to provide geotechnical information for the relocated Units 1 and 2.
 - Boring logs from these additional field explorations are presented in Appendix 2AA.



Switchyards

- 230 kV and 525 kV Switchyard Elevations Lowered
 - Elevation reduced from 600 ft. to 588 ft.
- Distance between Switchyards and Units 1 and 2
 - Units 1 and 2 moved south 66 ft.
 - Distance from the Units to the switchyards is reduced, but relative orientation remains unchanged.
- Salt Deposition Analysis is Unchanged



Gaseous Release Dose Assessment

- Updated to reflect changes in site-specific meteorology discussed in FSAR Section 2.3.
 - Dose assessment was updated and found the relocation of Units 1 and 2 has no adverse impact to the dose assessment results for the surrounding area.
- Milk pathway takes into account the worst case cow <u>or</u> goat milk impact in each sector analyzed.
- Maximum dose levels remain below regulatory limits.
 - Maximum individual dose levels remain below 10 CFR 50, Appendix I dose objectives.



Site-Specific Radiation Dose to Construction Workers

- Unit 1 moving 50 ft. closer to Unit 2 affects the construction worker dose
 - Calculated annual dose increased from 0.29 mrem to 0.397 mrem.
- Annual dose to construction worker remains below 10 CFR 20.1301 annual dose limits for the public.



Conforming Changes

- Table 19.58-201
 - Updated plant floor elevation
 - Updated external flood elevations

Non-Impacted FSAR Content



- Non-Impacted FSAR Chapters and Sections
 - Chapter 2
 - > Section 2.2
 - Chapter 4
 - Chapter 5
 - Chapter 6
 - Chapter 7
 - Chapter 9
 - Chapter 10
 - Chapter 13
 - Chapter 14
 - Chapter 15
 - Chapter 16
 - Chapter 17
 - Chapter 18

FSAR Chapter 2, Section 2.2



Off-Site Hazard Analyses

Explosions

- The analysis is based on a "nominal" center of the site from which lines are drawn to the nearest point of various accidents.
- Relocation does not invalidate the analysis conclusions

Flammable Vapor Cloud (Delayed Ignition)

- Analysis uses the site property boundary as the point of reference used to analyze distance from the hazard to the site.
- Relocation does not impact the property boundary, leaving the distance from the hazard to the site is unchanged.
- Analysis results remain below 1.0 psig limit specified in Reg. Guide 1.91.

FSAR Chapters 4 & 5



- Chapters Content
 - Incorporation by reference to the AP1000 DCD.
 - Programmatic information
- Content is not dependent on the location of Units 1 and 2.



Chapter Content

- Incorporation by reference to the AP1000 DCD and programmatic information.
- Assessment of control room habitability from the release of toxic chemicals either on-site or off-site.

On-Site Toxic Chemical Release

- The limiting distance is from the turbine building to the control room intake of the same unit.
- Relocation of Unit 1 50 ft. closer to Unit 2 does not affect this limiting distance.
- The distances from the cooling towers to the Units 1 and 2 control room intakes remain bounded by the distances discussed in the AP1000 DCD.

FSAR Chapter 6 (Cont'd)



Off-Site Toxic Chemical Release

- Analysis based on the site being 5100 meters from Highway 329 with a control room intake elevation 17 meters above grade.
- New locations of Units 1 and 2 increases the distance from the nearest approach of Highway 329.
- The increased distance from accident to receptor increases the dispersion of the gas and reduces its concentration prior to reaching the control room intake.
- Relocation of Units 1 and 2 has no adverse impact to the off-site toxic chemical release analysis.



- Chapter Content
 - Incorporation by reference to the AP1000 DCD and programmatic information.
 - Identification of site-specific information related to environmental monitoring; however, location of this instrumentation is not specified in the FSAR.
- Content is not dependent on the location of Units 1 and 2.



- Impact to Service Water System (SWS) Cooling Towers
 - FSAR states the SWS Cooling Towers performance is not affected by site layout or tower operation in the adjacent unit.
 - New locations of Units 1 and 2 were reviewed and found to have no impact on FSAR content.



Chapter Content

- Incorporation by reference to the AP1000 DCD and programmatic information.
- Conceptual design information related to site-specific design.
 - Cooling towers locations unchanged.
 - Results of SACTI analysis are not impacted by the relocation as they are only dependent on cooling tower design parameters and dimensions.

FSAR Chapters 13, 14, 15, 16, & 17



- Chapter Content
 - Incorporation by reference to the AP1000 DCD and programmatic information.
 - Site-specific information not impacted by location of Units 1 and 2.
- Content is not dependent on the locations of Units 1 and 2.



Chapter Content

- Incorporation by reference to the AP1000 DCD and programmatic information.
- Departures for the locations of the Technical Support Center (TSC) and Operations Support Center (OSC).
 - The buildings within which the TSC and OSC are located will be moved, but the locations of the TSC and OSC remain the same within the buildings.
- Content is not dependent on the locations of Units 1 and 2.

Environmental Impacts of Lee Relocation



- Water Impacts No increase in impacts to wetlands or waters of the U.S.
- Land impacts Minor changes due to plant relocation
 - Summary of temporary and permanent land use impacts will be updated.
- Meteorological Tower No impact to tower operation
 - Required clearance to plant structures and ground cover is maintained.
 - Distance and orientation of tower to plant structures will be updated.
- Dose Impacts No significant change
 - Dose results remain well below regulatory limits and meet ALARA objectives.
- Cooling tower plume No impact
 - Cooling tower locations are not changed.
- Off-site traffic No impact
 - Construction and operational activities are not changed.

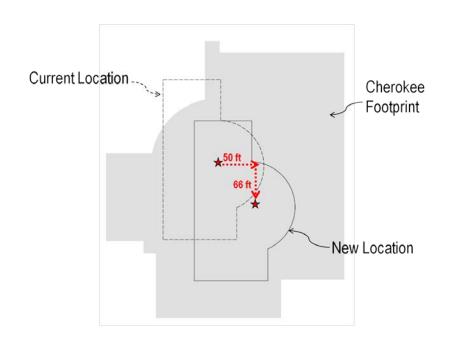
Preliminary Geotechnical and Structural Assessment



- Relocation required additional geotechnical investigations to ensure compliance with RG 1.132.
 - Five new borings at Unit 1; Two new borings at Unit 2
 - Verified field results first available in late November.
- Supporting analyses and FSAR content could not incorporate that information for December submittal.
- Enclosure 2 to December submittal provides:
 - Preliminary geotechnical assessment of relocation with previously verified information;
 - Comparison of new site geotechnical information information to existing geotechnical information; and
 - Description of scope of FSAR future revisions.
- Future submittal will include completed assessments.

Preliminary Assessment Conclusions

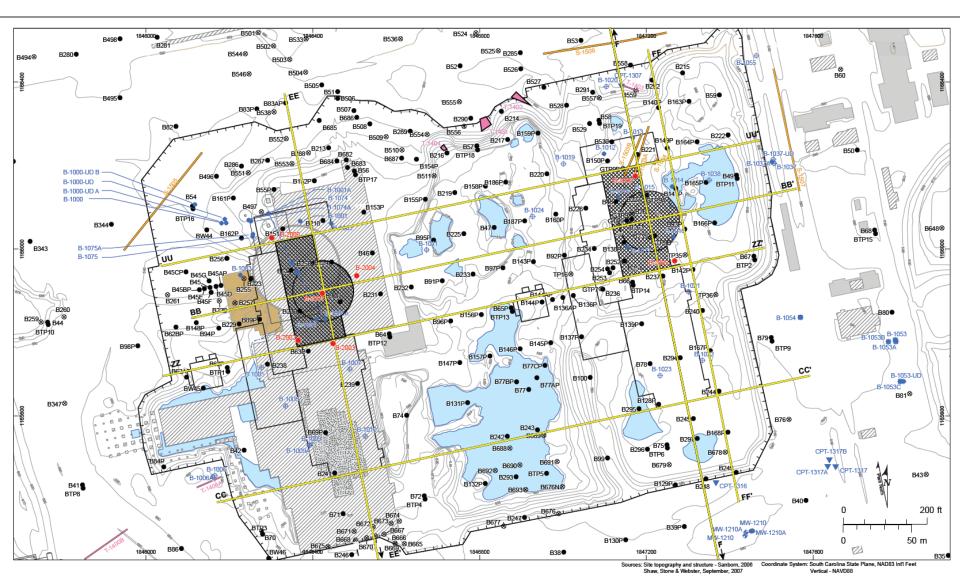




- Current FSAR geotechnical discussion and analysis is valid for relocated units.
- Relocated Unit 1 is entirely underlain by former Cherokee foundation over previouslymapped continuous rock.
- Northwest Corner discussions are no longer relevant.
- Eastern edge of Relocated Unit 2 will require localized area of fill concrete, with no significant effect.

Site Exploration Map - 2012





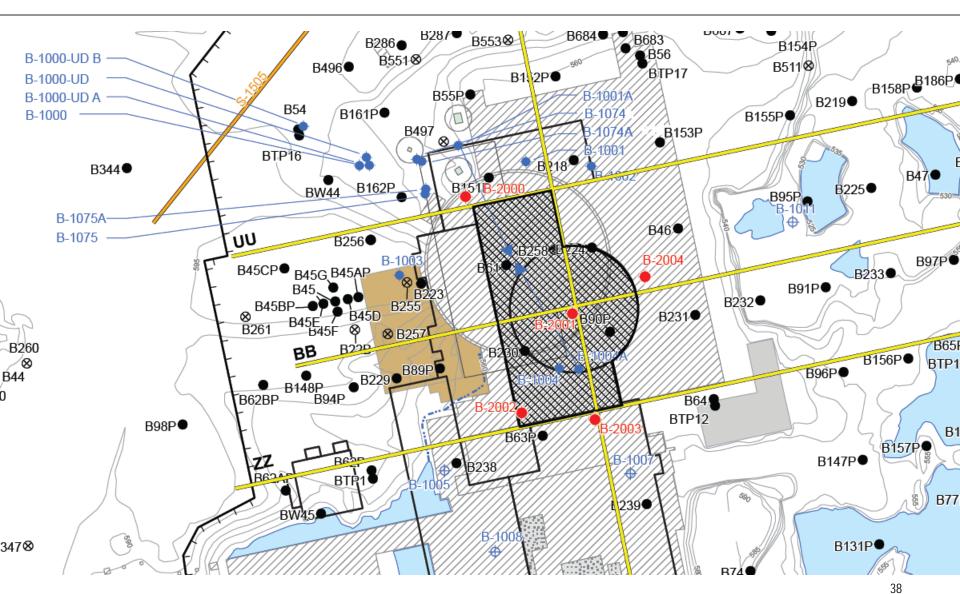
Summary of Completed Borings and In-Situ Testing



Facility or Zone	Boring Number	Depth (ft bgs)		In-Situ Testing					
		Proposed	Actual	P-S Velocity	Downhole Velocity	Tele- viewer	Goodman Jack	Pressure- meter	Packer Test
Unit 1	B-2000	125	126	Χ		Χ			
	B-2001	100	100.5						
	B-2002	100	225.6	Χ		Χ			
	B-2003	225	54.6			Χ			
	B-2004	100	101						
Unit 2	B-2005	225	225	Χ		Χ			
	B-2006	100	101						

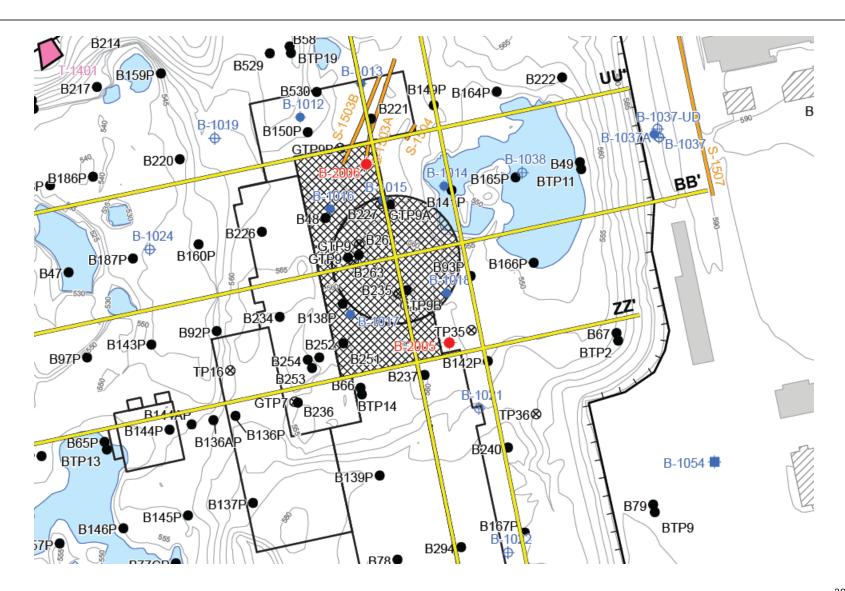
Exploration Map – Relocated Unit 1





Exploration Map – Relocated Unit 2





Results Presented



- Boring Summary Sheets (Seven Borings)
 - Concrete and rock coring results
 - P-S suspension logging
- Interpretation of subsurface conditions and materials (selected geologic cross-sections)
- Comparison to FSAR test results (geotechnical)
 - P-S Suspension
 - RQD-Based (static) Modulus Profile
 - Shear Wave-Based (static) Modulus Profile.
- Update to Dynamic Profile Base Case A1

Boring Summaries



At Unit 1,

- No significant cracking of Cherokee structural slab.
- Continuous rock was encountered beneath the Cherokee slab and fill concrete.
- Rock was observed to be consistent with past evaluations.
- At Boring B-2000, high RQD was encountered under the existing concrete, confirming that conditions in the former Unit 1 northwest corner are not present after relocation.

At Unit 2,

- Borings located continuous rock 3 ft. to 5 ft. below existing ground surface
- Observed characteristics consistent with FSAR Rev. 6.

Geophysical Logging



- Acoustic Televiewer Logging Unit 1 (B-2000, B-2002, and B-2003)
 - Concrete-rock interface is irregular, very tight, with absence of major fracturing or separation.
 - Rock below the fill concrete exhibits slight to slightly moderate fracturing with slight to moderate weathering.
- Acoustic Televiewer Logging Unit 2 (B-2005)
 - Rock near surface exhibits slight to slightly moderate fracturing with slight to moderate weathering.
 - Foundation-Quality rock near the top of the hole.

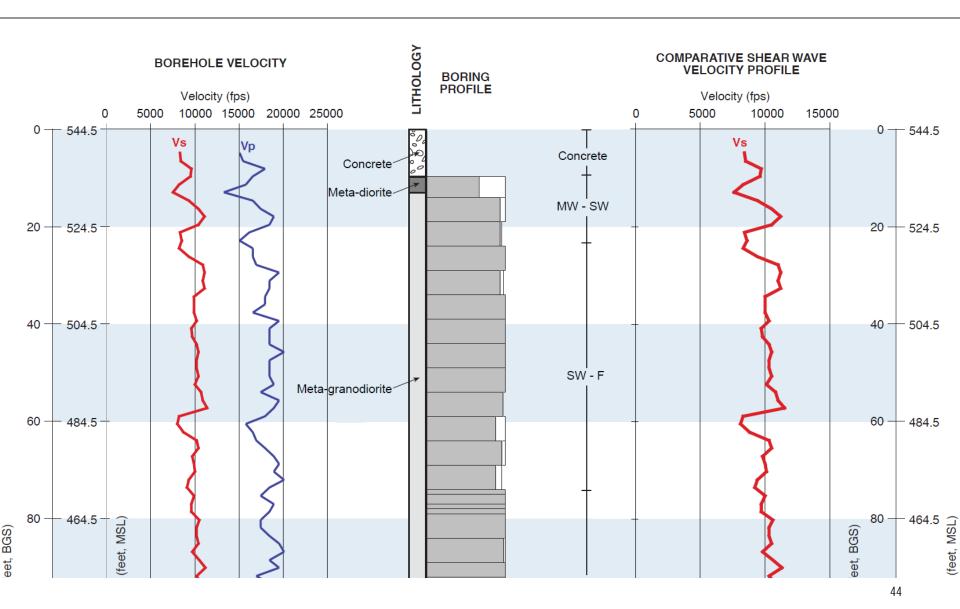
Geophysical Logging (Cont'd)



- P-S Suspension Logging Unit 1
 - V_s and V_p data are consistent with previous results and correlate well with FSAR Revision 6, confirming Base Case A1.
 - V_s and V_p data for Boring B-2000 confirm that conditions at the former northwest corner are not present after relocation.
- P-S Suspension Logging for Unit 2 is consistent with FSAR Rev. 6, confirming Profile C for Unit 2.

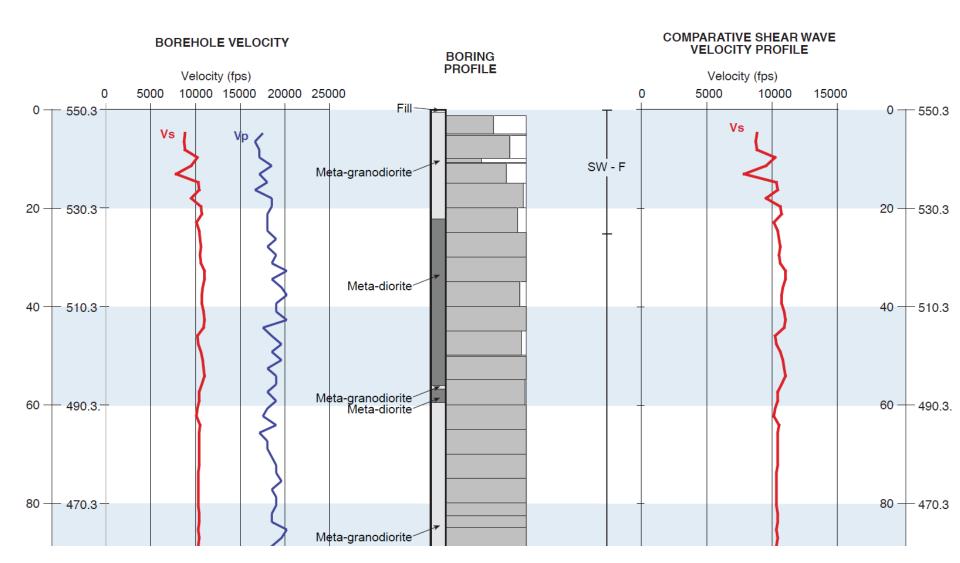
Sample Boring Summary (B-2000 – Unit 1)





Sample Boring Summary (B-2005 – Unit 2)





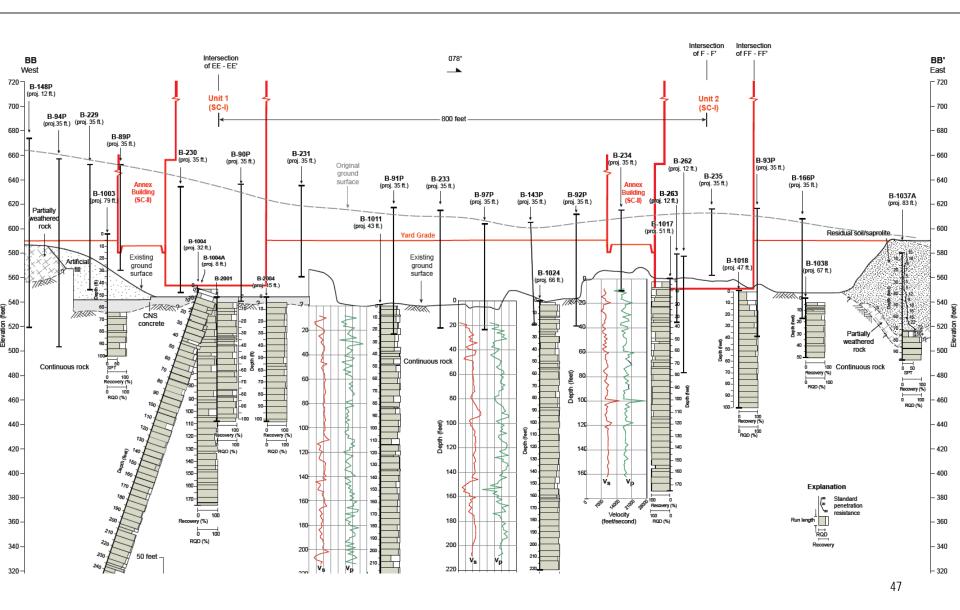
Geologic Cross-Sections



- Illustrate the results of coring and borehole testing, including interpretation of subsurface materials.
- Offer understanding of future excavation and fill concrete requirements.
 - Additional 3 ft. fill concrete beneath Unit 1.
 - Fill concrete under localized area on eastern edge of Unit 2.
 - Decision to add fill concrete in support zone of SC-II buildings to level of bottom of nuclear island.

Geologic Cross-Section BB-BB' Thru Centers of Units Puke Energy.





Pre-Construction Activities

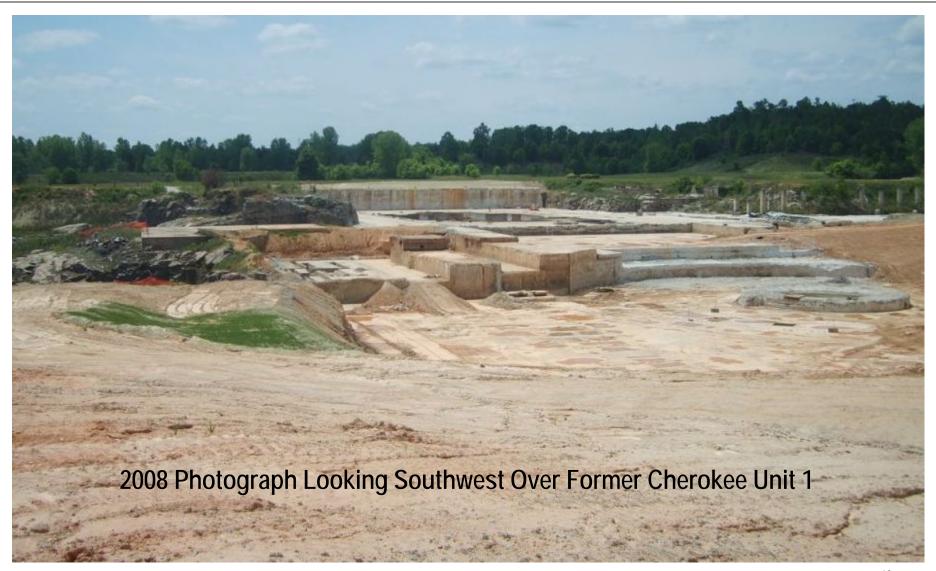


- Lee Unit 1 is entirely underlain by Cherokee concrete over previously-mapped rock.
- Because of different footprints of legacy Cherokee structures, some additional excavation will be required, and may expose previously-mapped foundation rock (picture on next slide).
- Exposed rock at Lee Unit 1 will be mapped and compared to the previous Cherokee mapping to confirm FSAR interpretations.
- Lee Unit 2 foundation rock will be mapped in detail as a preconstruction activity.
- Mapping will be as described in FSAR Subsection 2.5.4.4.3.1 and FSAR Table 2.5.4-219.

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Future Excavation - A Thousand Words





Static Stability – Bearing Capacity and Settlement



- Modulus properties are demonstrated to be consistent with those already described in the FSAR.
- Estimated Nuclear Island settlement is confirmed to be very small and less than DCD limits.
- Nuclear Island foundation bearing capacity is determined to exceed DCD requirements.

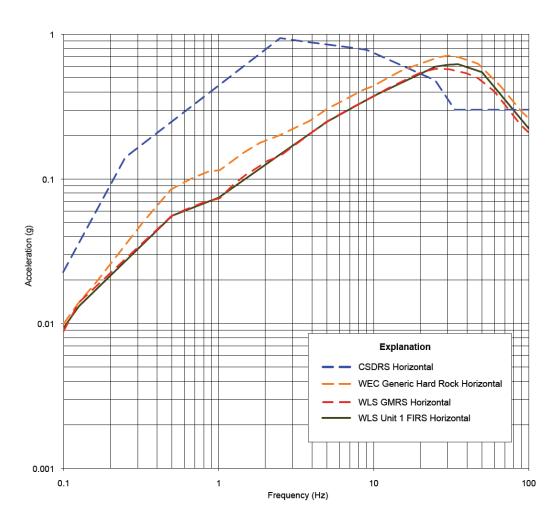
Dynamic Profiles



- Rock properties in new locations are very similar to those in the old locations.
- Thickness of fill concrete at Unit 1 is increased by around 15% (about 23 ft. instead of 20 ft.).
- Preliminary evaluations indicate negligible variation in site response calculations for Unit 1 (Base Case A1).
- Preliminary evaluations indicate updated Unit 1 FIRS will have similar characteristics, and remain less than AP1000 HRHF spectrum.
- Unit 2 (Profile C) input is still the site GMRS.

Horizontal Unit 1 FIRS vs GMRS





- Current FSAR Figure
 3.7-201 compares
 horizontal Unit 1 FIRS
 to site rock spectrum
 (GMRS).
- Illustrates effect of 20 ft. fill concrete over hard rock.
- Effect of about 23 ft. fill concrete instead of 20 ft. will be only slightly different.

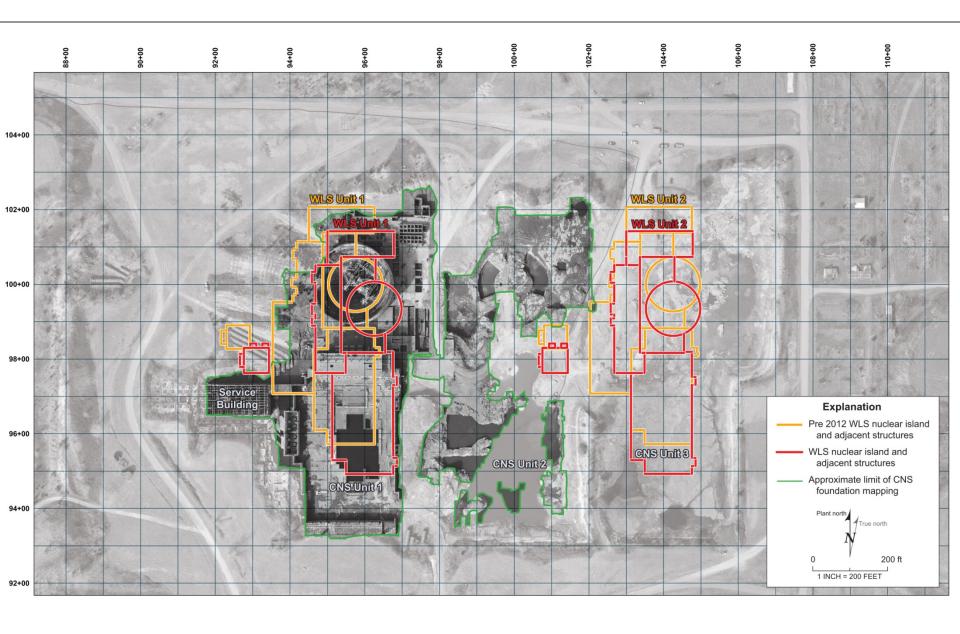
Expected Changes - FSAR Section 2.5



- 2.5.1 Basic Geologic and Seismic Information No significant changes.
- 2.5.3 Surface Faulting No significant changes.
- Rock core and televiewer results confirm the results presented in Cherokee Mapping Report (DUK-001-PR-01)
 - Rock lithology underlying new locations is similar to initial location.
 - Structural Features (e.g. joints, fractures, shears, brecciated zones, including features demonstrating secondary mineralization) demonstrate similar relationships to features documented and mapped at Cherokee Units 1 and 2.
- Assessments presented in DUK-001-PR-01 remain valid.
- The site has not experienced tectonic deformation since the Mesozoic, and possibly not since 219 Ma to 300 Ma.

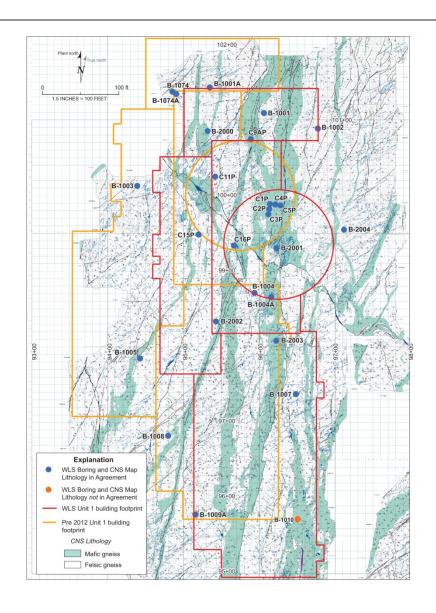
Update to DUK-001-PR-01





Update to DUK-001-PR-01





- Relocated plant is entirely underlain by former Cherokee concrete overlying mapped rock surfaces.
- 2012 investigations confirm findings reported in DUK-001-PR-01.
- Cherokee Mapping Report
 DUK-001-PR-01 will be updated
 to reflect relocated plant,
 demonstrating and supporting
 the assessment of no significant
 changes.

Planned Changes - FSAR Section 2.5 (Cont'd)



- 2.5.4.2.4 Material Properties Minor text revisions
- 2.5.4.3 Foundation Interfaces Descriptions of revised configurations
- 2.5.4.5 Excavations and Backfill
 - Eliminate discussion of Unit 1 northwest corner
 - Describe fill concrete in localized area on eastern edge of Unit 2 nuclear island.
 - Describe use of fill concrete in support zone of SC-II buildings to ensure same configuration as DCD

Planned Changes - FSAR Section 2.5 (Cont'd)



2.5.4.7 Response of Soil and Rock to Dynamic Loading

- Confirm foundation uniformity for relocated Units, in compliance with DCD.
- Remove discussions of the former Unit 1 northwest corner (e.g. Profile B).
- Update dynamic profile Base Case A1 to reflect additional 3 ft. of fill concrete.
- Describe negligible effect of localized areas of fill concrete for Unit 2.
- Update granular fill properties to reflect additional 2.5 ft. of non-buoyant fill material.

Planned Changes - FSAR Section 2.5 (Cont'd)



- 2.5.4.10 Static Stability
 - Update presentation of bearing capacity for nuclear island
 - Update presentation of nuclear island settlement
 - Update bearing capacity of granular fill for support of SC-II buildings (different depth to groundwater)
- 2.5.5 Stability of Slopes No significant changes

Planned Changes - FSAR 2.5 (Cont'd)



2.5.2 Vibratory Ground Motion

- Confirm site profiles used to compute GMRS and Unit 1 FIRS.
- Present updated Unit 1 FIRS considering additional 3 ft. of fill concrete.
- Preliminary evaluations indicate that Unit 1 FIRS will be similar, and still less than DCD HRHF spectrum.

Planned Changes - FSAR 3.7



Nuclear Island

- Demonstrate uniformity of hard rock support conditions
- Demonstrate GMRS and Unit 1 FIRS are less than HRHF

Seismic Category II Buildings

- Demonstrate uniform fill concrete to level of base of nuclear island, providing DCD-like uniform support conditions.
- Demonstrate selected granular fill has V_s greater than 500 fps.
- Demonstrate adequate granular fill bearing capacity.
- Demonstrate that GMRS and Unit 1 FIRS are less than HRHF.
- No site-specific analyses are required to demonstrate compliance with DCD.

Summary of Plant Relocation



Units 1 and 2 Relocation

- Unit 1 Shift 66 ft. South and 50 ft. East
- Unit 2 Shift 66 ft. South

Relocation Benefits

- Manage project construction risks that would have been associated with the construction activities in the northwest corner of Unit 1.
- Improve site characteristics.

Relocation Impacts to COL Application

- No adverse impacts to Hydrology, Meteorology, or Hazards analyses.
- Preliminary assessment of Geotechnical and Seismic areas show no adverse impacts.

Next Steps



- Complete update to supporting seismic/geotechnical calculations
- Update RAIs to reflect relocation impacts
- Update Environmental Information
- Submit COLA Rev 7
 - Plant relocation impacts
 - Emergency Plan update for EP Rule
 - Fukushima response (other than CEUS)



QUESTIONS?