NRCR00012

Presentation to the Commission

Combined License Application Review
Vogtle Units 3 and 4

SER Panel 3

September 27 – 28, 2011

U.S.NRC

United States Nuclear Regulatory Commission

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Chapter 19, Probabilistic Risk Assessment and Severe Accidents

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Information Incorporated by Reference: Aircraft Impact Assessment (AIA)

- AP1000 AIA is reasonably formulated per the guidance in NEI 07-13
- Credited key design features are identified and their functional capabilities are described in the DCD – ensure that:
  - The reactor remains cooled and the containment remains intact
  - Spent fuel cooling and spent fuel pool integrity is maintained
  - Credited post-impact safe shutdown equipment is protected from fire damage

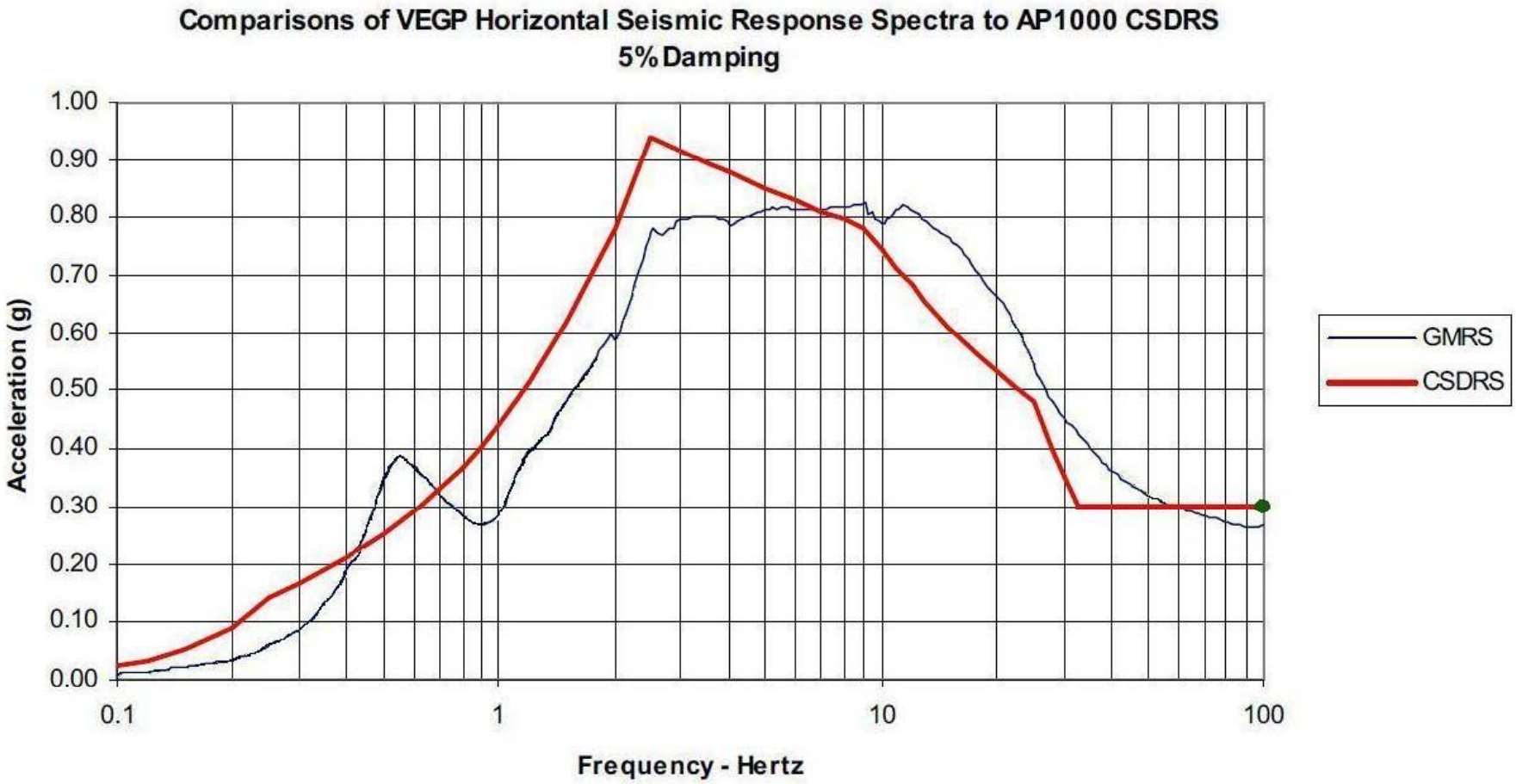
Information Incorporated by Reference: Aircraft Impact Assessment (AIA)

- Key Design Features:
  - Design
    - Shield Building design
    - Auxiliary Building design
  - Design and location
    - Turbine and Annex building walls
    - Spent fuel pool (Auxiliary Building)
    - Main control room
    - Remote shutdown station, and
    - Secondary diverse actuation system (DAS)

Overview of Vogtle COL FSAR Chapter 19

Sections	Content	Topics of Interest
Sections 19.1 through 19.54, 19.56 and 19.57; Appendices 19A-19F	Incorporated by reference (IBR)	
Section 19.55, Seismic Margin Analysis	Plant-Specific	Seismic Margin Analysis
Section 19.58, Winds, Floods, and Other External Events	Plant-Specific	External Events
Section 19.59, PRA Results and Insights	Standard	

GMRS vs. CSDRS



VEGP AP1000 Horizontal Spectra Comparison

VEGP SUP 3.7-3

Seismic Margin Analysis: Vogtle COL FSAR Section 19.55

- Site-specific ground motion response spectra (GMRS) exceed the AP1000 certified seismic design response spectra (CSDRS).
- SNC performed site-specific analysis of six locations. These correspond to the locations for which in-structure response spectra (ISRS) had been developed for the DC amendment.
- Above 1 Hz, ISRS for all evaluated locations at Vogtle were bounded by the ISRS of the certified design. (A small exceedance at very low frequency was shown to have no impact on AP1000 seismic SSCs.)
- Adequate seismic margin was demonstrated for 1.67 times the GMRS.
- The staff concluded that the applicant had demonstrated adequate seismic margin for Vogtle 3 & 4.

Vogtle External Events

External Event	Screening Criteria Applied			
	Bounded	Negligible Frequency	Negligible Consequence	Not Applicable
Tornado	●			
Hurricane	●			
External flood				Max flood < 220' (Vogtle Plant grade)
Aviation	●	●		
Marine				No barge traffic
Pipeline	●		●	No pipelines for 10 mi.
Railroad			●	$D_{closest\ track} > D_{standoff}$
Truck			●	$D_{closest\ highway} > D_{standoff}$
Major depots and storage areas			●	< NRC review standard
On-site storage tanks			●	< RG 1.78
External fires			●	
Radiological hazards			●	

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Chapter 19A, Loss of Large Areas (LOLA) of the Plant Due to Explosions or Fires

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Applicable Requirements

- Requirements for COL applicants pertaining to Loss of Large Areas (LOLAs) of the Plant Due to Explosions or Fires are covered in Section 52.80(d) and Section 50.54(hh)(2)

- Section 52.80(d) requires a COL applicant to describe its plans for meeting the requirements in Section 50.54(hh)(2)

- Section 50.54(hh)(2) requires licensees to address LOLA with strategies and guidance for restoring or maintaining:
  - Core cooling
  - Containment capability
  - Spent Fuel Pool Cooling

- Requirements are the same for current licensees, but COL applicants may credit unique design features, or those incorporated to meet the Aircraft Impact Assessment (AIA) rule (Section 50.150). Part 50 applicants are not subject to the AIA rule, but may credit any unique design features

Review Approach

- Staff reviewed applicant's description and plans for implementing strategies and guidance to address LOLA.
- Staff followed review guidance in Interim Staff Guidance document DC/COL-ISG-16, which:
  - Endorses industry guidance in NEI 06-12 Revision 3,
  - Incorporates by reference additional guidance issued to operating reactor licensees and not in NEI 06-12,
  - Includes guidance for addressing generic lessons learned from NRC inspections at operating reactors.
- Knowledgeable and experienced staff review team
  - Members of original Task Force for implementation of LOLA requirements in Interim Compensatory Measures Order,
  - Developed guidance in DC/COL-ISG-16.

Summary of Staff Evaluation

- Over 90 Requests for Additional Information Issued:
  - Clarification of submitted information,
  - Documentation of commitments,
  - Technical concerns leading to significant changes to the strategies.
- Most technical details of staff's review are sensitive security-related information and accordingly are kept non-public.
- Key Issues
  - Connection of equipment walk-through, including electrical equipment, fire hoses (size and length), pumping capability;
  - Maintenance activities for mitigative strategies equipment;
  - Implementation schedule;
  - Deviation from guidance for spent fuel pool cooling.

Staff Conclusions

- Applicant followed NRC guidance; departures acceptable.
- Applicant addressed staff's questions acceptably with modifications to its application.
- Applicant's description of guidance and strategies meets Section 52.80(d) requirements.
- Staff has reasonable assurance that strategies and guidance will be developed and implemented in accordance with Section 50.54(hh)(2), and prior to fuel load.

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Chapter 15, Accident Analysis

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Overview of Vogtle COL FSAR Chapter 15

Section	Content	Topics of Interest
15.0 Accident Analysis	Incorporated by Reference (IBR)/Standard	Plant Calorimetric Uncertainty Methodology
15.1 Increase in Heat Removal from Primary System	IBR	
15.2 Decrease in Heat Removal by the Secondary System	IBR	
15.3 Decrease in Reactor Coolant System Flow Rate	IBR	
15.4 Reactivity and Power Distribution Anomalies	IBR	

Overview of Vogtle COL FSAR Chapter 15

Section	Content	Topics of Interest
15.5 Increase in Reactor Coolant Inventory	IBR	
15.6 Decrease in Reactor Coolant Inventory	IBR/ Plant-Specific	
15.7 Radioactive Release from a Subsystem or Component	Plant-Specific	
15.8 Anticipated Transients without SCRAM	IBR	
15A Evaluation Models and Parameters for Analysis of Radiological Consequences of Accidents	IBR/ Plant-Specific	DBA Radiological Consequences Analyses

Plant Calorimetric Uncertainty Methodology

- The staff required the applicant to provide an NRC approved method of measuring feedwater flow to produce a power uncertainty of 1 percent or lower assumed in Large Break LOCA analysis
- Applicant proposed the Caldon CheckPlus™ flow meter design and referenced topical reports ER-80P and ER-157P in the FSAR
- ITAAC will confirm installation and appropriate uncertainty measured
- License condition (prior to initial fuel load):
  - Availability of documented instrumentation uncertainties to calculate a power calorimetric uncertainty
  - Availability of administrative controls to implement maintenance and contingency activities related to the power calorimetric uncertainty instrumentation

Design Basis Radiological Consequences Analyses (cont'd)

- **Issue**
  - Vogtle COL incorporated by reference the DBA dose analyses from the AP1000 DCD by showing that the site-specific input to the analyses is bounded by the assumptions in the DCD.
    - Applicant needed to demonstrate compliance with offsite dose factors in 10 CFR 52.79(a)(1) and the control room dose criterion in GDC 19.
    - VEGP DEP 18.8-1 site-specific TSC design - TSC habitability analysis was reviewed separately (SER 13.3).

Design Basis Radiological Consequences Analyses (cont'd)

- **Resolution**
  - Site characteristic accident atmospheric dispersion (χ/Q) values are the only site-related DBA dose analysis input.
  - Site characteristic accident χ/Q values for offsite, control room and technical support center receptors were provided for staff review.
    - FSAR Tables 2.3-201 and 2.3-202.
    - Site characteristic χ/Q values were found acceptable (FSER 2.3).
  - Vogtle χ/Q values are less than AP1000 χ/Q values.
  - Dose is directly proportional to the χ/Q value; therefore, Vogtle DBA doses are less than AP1000 DBA doses.
  - AP1000 DCD shows compliance with the offsite and control room dose factors for all DBAs; therefore, Vogtle also complies.

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Chapter 7, Instrumentation and Controls

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Protection and Safety Monitoring System Actuation System (PMS)

- Four divisions (each has own sensors)
- 2 out of 4 coincidence logic
- Common Q platform
- Actuates reactor trip
- Actuates engineered safeguards
- Provides post-accident monitoring

Diverse Actuation System (DAS)

- As protection from common-cause failure of the PMS, the original design required a DAS.
- The system has automatic and manual modes of operation, and the automatic system is 2-out-of-2 logic.
- DAS manual actuation is hard-wired to the final loads bypassing the PMS and DAS automatic logic.
- DAS can automatically:
  - Actuate a reactor and turbine trip
  - Initiate PRHR, CMTs
  - Trip RCPs.

Diverse Actuation System (DAS)

- Manual actuation capability is also provided for:
  - Passive Containment Cooling System (PCS)
  - Automatic depressurization system (ADS)
  - Some containment isolation
  - Hydrogen igniters
  - IRWST injection
  - Containment recirculation actuation.
- Manual mode is controlled by TS (30 day completion time). Automatic mode is controlled by availability controls (14 days).

- DAS functionality and architecture was part of the original design. The amendment provided design information to remove the DAS design acceptance criteria.

Diverse Actuation System (DAS)

- ACRS raised a concern that there is no explicit limitation on having both the automatic and manual modes of DAS unavailable at the same time. Staff noted that the likelihood of event, DAS and PMS design features, and operational programs address the concern.

- Follow-up ACRS letter in May 2011 repeated the concern and also stated that the 30 days technical specifications completion time is too long.

- Staff response of July 6, 2011, noted that technical specifications completion time was consistent with regulatory practice.

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Chapter 8, Electric Power

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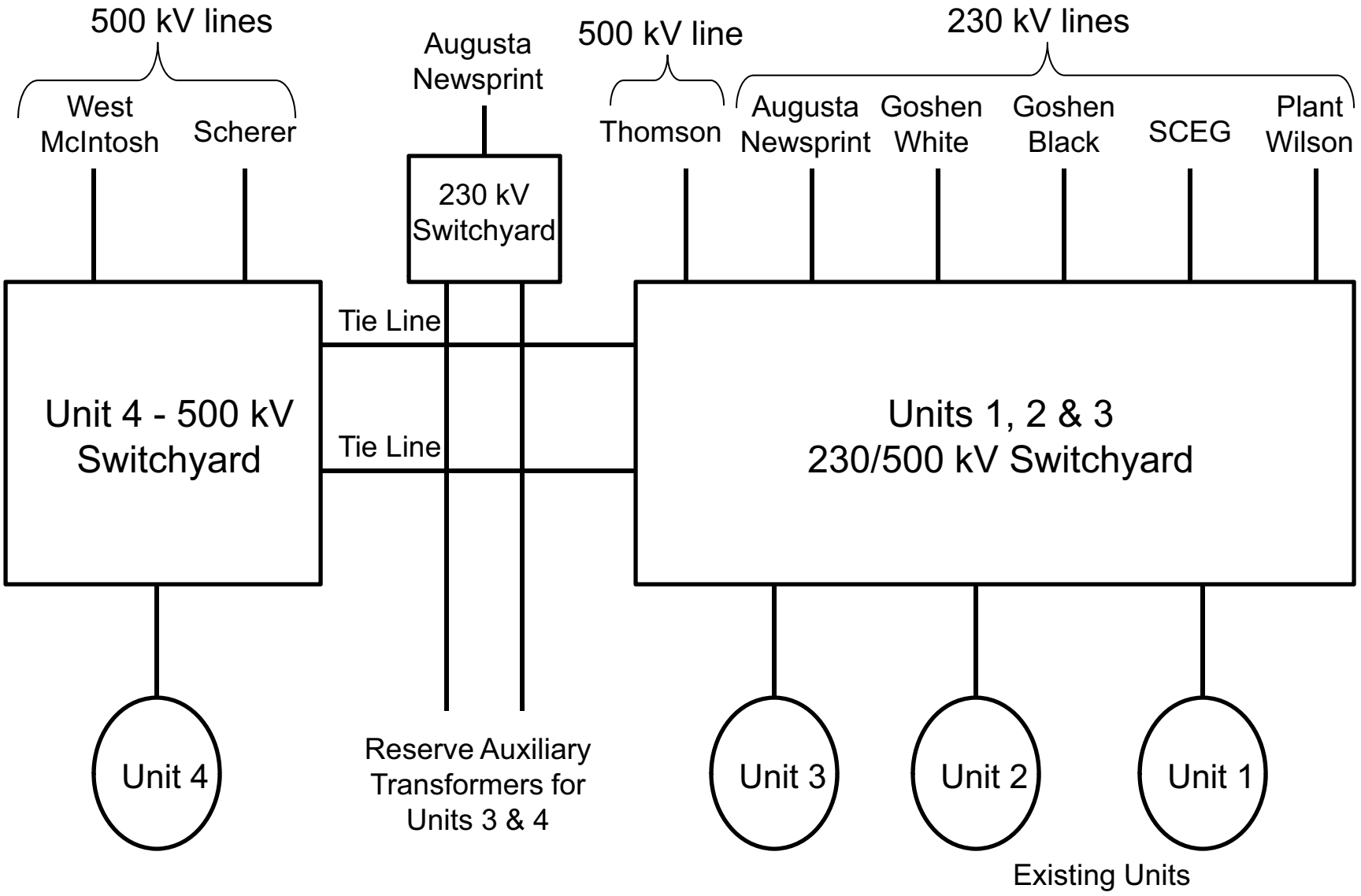
Overview of Vogtle COL FSAR Chapter 8

Section	Content	Topics of Interest
8.1 Introduction	Plant-Specific	
8.2 Offsite Power System	Plant-Specific	Offsite Power Condition Monitoring Program for Under Ground and Inaccessible Cables
8.2.A Site-Specific ITAAC for Offsite Power System	Standard/Plant-Specific	ITAAC for Offsite Power System
8.3.1 AC Power System	Standard	
8.3.2 DC Power System	Standard	Departure Related Testing of Voltage Regulating Transformers

Offsite Power

- Unit 3 is connected to the 230/500 kilovolt (kV) switchyard, which is supplied by five 230kV overhead transmission lines and one 500 kV overhead transmission line coming from other substations.
- Unit 4 is connected to a different 500 kV switchyard, which is supplied by two 500kV overhead transmission lines coming from other substations.
- Grid stability analysis was performed by the applicant to satisfy the DCD interface requirement for maintaining adequate reactor coolant pump voltage for 3 seconds after a turbine trip, which was accepted by the staff.

Vogtle Switchyard Configuration



Condition Monitoring Program for Underground or Inaccessible Cables

- **Issue:**
  - The application did not initially include a monitoring program to detect degradation of inaccessible or underground control or power cables that support systems which are within the scope of 10 CFR 50.65, the Maintenance Rule.

- **Resolution:**
  - The applicant incorporated a condition monitoring program for underground or inaccessible cables into the maintenance rule program.

ITAAC for Site-Specific Offsite Power System

- **Issue:**
  - 10 CFR 52.79(d) and 10 CFR 52.80(a) requires that ITAAC be provided for a site-specific system.
  - Applicant did not initially provide any ITAAC for the site-specific offsite power system.

- **Resolution:**
  - The applicant included ITAAC for the offsite power system so that the as-built offsite portion of the power supply from the transmission network that interfaces with the plant onsite ac power will be verified to perform as designed.

Periodic Testing of Voltage Regulating Transformers (AP1000 Departure)

- **Issue:**
  - The AP1000 DCD states that Class 1E regulating transformers are designed to limit the input current to an acceptable value under faulted conditions on the output side.
  - However, the applicant indicated that the voltage regulating transformers do not have active components to limit fault current.
  - The applicant proposed the use of the breakers/fuses for regulating transformers for isolation function in lieu of current limiting feature.
- **Resolution:**
  - Staff concluded that this departure is acceptable because the isolation function provided by the use of the breakers/fuses for regulating transformers is consistent with the criteria for independence of electrical safety systems.

Acronyms

ACRS	– Advisory Committee on Reactor Safeguards
ADS	– Automatic Depressurization System
AIA	– Aircraft Impact Assessment
CMT	– Core Makeup Tank
COL	– Combined License
CSDRS	– Certified Seismic Design Response Spectra
DAS	– Diverse Actuation System
DBA	– Design Basis Accident
DCD	– Design Control Document
ER	– Engineering Report
ESP	– Early Site Permit
FSAR	– Final Safety Analysis Report
FSEIS	– Final Supplemental Environmental Impact Statement
GDC	– General Design Criteria
GMRS	– Ground Motion Response Spectra
Hz	– unit measuring frequency in cycles per second
IBR	– Incorporated by Reference
IDLH	– Immediately Dangerous to Life or Health
ISRS	– In-Structure Response Spectra
ITAAC	– Inspections, Tests, Analyses, and Acceptance Criteria
LOLA	– Loss of Large Areas of the Plant Due to Explosions or Fires
LWA	– Limited Work Authorization
kV	– unit measuring electric potential in kilovolts
NEI	– Nuclear Energy Institute
NSIR	– Office of Nuclear Security and Incident Response
PCS	– Passive Containment Cooling System
PMS	– Protection and Safety Monitoring System Actuation System
PRHR	– Passive Residual Heat Removal
QA	– Quality Assurance
RCOL	– Reference Combined License
RCP	– Reactor Coolant Pump
RCS	– Reactor Coolant System
RG	– Regulatory Guide
SCOL	– Subsequent Combined License
SSC	– structures, systems, and components
(F)SER	– (Final) Safety Evaluation Report
SNC	– Southern Nuclear Operating Company
TS	– technical specifications
TSC	– Technical Support Center
VEGP	– Vogtle Electric Generating Plant
WEC	– Westinghouse Electric Company
10 CFR	– Title10 of the Code of Federal Regulations