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United States Nuclear Regulatory Commission

Protecting People and the Environment

Presentation to the Commission

Combined License Application Review Vogtle Units 3 and 4

SER Panel 4

September 27–28, 2011

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Chapter 13, Conduct of Operations

September 27 – 28, 2011

Purpose

- Summarize staff's evaluation of FSAR Chapter 13 of the Vogtle COL application
  - Standard content of AP1000 design incorporated by reference
  - Emergency planning review at ESP stage
    - Limited scope of review at COL stage
  - Cyber security review

Overview of Vogtle COL FSAR Chapter 13

FSAR Section	Content	Topics of Interest
13.1 Organizational Structure of Applicant	Plant-Specific	
13.2 Training	Standard	
13.3 Emergency Planning	Standard/Plant-Specific	Emergency Planning
13.4 Operational Programs	Standard/Plant-Specific	
13.5 Plant Procedures	Standard	
13.6 Physical Security	Standard/Plant-Specific	
13.7 Fitness for Duty	Standard	
13.8 Cyber Security	Plant-Specific	Cyber Security

Overview of Emergency Planning

- The COL application incorporates by reference the early site permit (ESP) and the AP1000 standard design
- The ESP application included the complete & integrated emergency plans, consisting of:
  - Onsite emergency plan (including ETE and ITAAC)
  - Offsite (State & local) emergency plans
- NRC reviewed the onsite plan & FEMA reviewed the offsite plans
  - ESP evaluation results documented in Section 13.3 of NUREG-1923
- 10 CFR 52.83 – Limits the scope of EP review for COL application referencing ESP or DC

Emergency Action Levels (EALs)

ESP-004 Permit Conditions 2 through 7

- Emergency Action Levels (EALs)
  - Reflect NEI 07-01
  - Reflect completed AP1000 design
  - Based on in-plant conditions, including State & local review
- Staff's review
  - Applicant's commitment regarding EALs satisfies applicable regulatory requirements
  - The staff proposes a license condition to capture the commitment

Technical Support Center (TSC)

- Permit Condition 8
  - Common Technical Support Center (TSC) for Units 1-4
  - AP1000 TSC location
    - AP1000 Departure 18.8-1
    - ESP Variance 1.2-1

- TSC Habitability
  - Appendix E to 10 CFR Part 50, and NUREG-0696
  - Radiological and non-radiological analyses
  - ITAAC (Acceptance Criterion 5.1.8)
  - Staff's Review
    - Independent verification of radiological analysis

Technical Support Center (TSC)

- AP1000 Departure 18.8-1
  - At the ESP stage, Staff found that the common TSC location was acceptable, subject to a demonstration of adequacy during the full participation exercise (Unit 3 ITAAC 8.1)
  - At the COL stage, Permit Condition 8 required the applicant to resolve the difference between the AP1000 TSC location (Annex Bldg.) and the common TSC (Departure 18.8-1)
  - Units 3 & 4 TSC moved from the Annex Bldg. Control Support Area (CSA) to a common TSC in the Communication Support Center (CSC)
  - The applicant also requested an ESP variance (Variance 1.2-1), which slightly moved the TSC location within the protected area

ACRS Review

- ACRS Action Items
  - Demonstrate the capability of TSC and Emergency Operations Facility (EOF) equipment and data displays to clearly identify and reflect the affected unit
  - Applicant added Unit 3 EP ITAAC Acceptance Criterion 8.1.1.D.2.d
    - Unit 3 exercise
  - Staff reviewed this ITAAC and found it acceptable because it is consistent with NUREG-0800

Post-COL Activities

- License conditions, implementation milestones, & ITAAC
  - Submit EALs & EIPs at least 180 days prior to fuel load
  - Submit EP program implementation schedule
  - Full participation exercise within 2 years of fuel load
  - Onsite exercise within 1 year of fuel load
  - EP ITAAC completion prior to fuel load

Conclusions

- **Early Site Permit (ESP) Review**
  - Complete & integrated emergency plans were reviewed
  - NRC & FEMA concluded emergency plans are adequate, and there is reasonable assurance they can be implemented (subject to the permit conditions and ITAAC)
- **Combined License (COL) Review**
  - Staff's review was limited to matters not resolved during the ESP review
  - Permit conditions & COL action items were adequately addressed
  - ITAAC carried forward into the COL (10 CFR 52.80(a))
  - There is reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency at Vogtle Units 3 & 4 (10 CFR 50.47(a)(1)(ii))

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Chapter 13.8, Cyber Security

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Background:
Cyber Security History

- Order EA-02-026, “Interim Safeguards and Security Compensatory Measures for Nuclear Power Plants” (2002)
- NUREG/CR-6847, “Cyber Security Self-Assessment Method for U.S. Nuclear Power Plants (2003)”
- NEI 04-04, “Cyber Security Program for Power Reactors (2005)”
- 10 CFR 73.1, Design Basis Threat Rule (2007) Regulatory Guide 5.69, “Guidance for the Implementation of the Radiological Sabotage Design-Basis Threat”

Background:
10 CFR 73.54 (March 2009)

- High assurance that digital computer and communication systems and networks associated with the following are adequately protected against cyber attacks, up to and including the design basis threat as described in § 73.1:
  - Safety-related and important-to-safety functions
  - Security functions
  - Emergency preparedness functions, including offsite communications
  - Support systems and equipment which, if compromised, would adversely impact safety, security, or emergency preparedness functions

Background:
10 CFR 73.54 (March 2009)

- Achieve high assurance by implementing defense-in-depth protective strategies:
  - Defensive architecture
  - Apply cyber security controls
  - Implement cyber incident response and mitigation programs
  - Maintain the program and address new cyber security vulnerabilities

- Submit a cyber security plan that satisfies the cyber security requirements

Background: Regulatory Guide 5.71

- Regulatory Guide 5.71, “Cyber Security Programs for Nuclear Facilities,” published January 2010
  - Framework
  - Security Controls
  - Cyber Security Plan Template

Background: Regulatory Guide 5.71

- Regulatory Guide 5.71, “Cyber Security Programs for Nuclear Facilities,” published January 2010
  - Insight gained since 2002
  - Insight and recommendations from cyber security experts and industry
  - Well-established NIST standards
    - NIST SP 800-53, “Recommended Security Controls for Federal Information Systems and Organizations”
    - NIST SP 800-82, “Industrial Control System Security”

Background: Regulatory Guide 5.71

- Regulatory Guide 5.71 was vetted for more than a year by:
  - Nuclear power industry
  - Cyber security experts
- Referenced by DHS
- Considered acceptable by FERC and NERC to meet their cyber security requirements

Vogtle CSP Review

- As part of the Vogtle COL application, SNC submitted a cyber security plan based on RG 5.71
- Plan included some deviations from the template provided in RG 5.71
- Provided additional information and clarifications on site-specific conditions affecting program implementation
  - Mostly minor
  - One non-minor deviation: cyber security defensive architecture

Staff Determination

- Staff evaluated each deviation and determined it was acceptable
  - Deviations maintained the intent of template sections and did not reduce protection for critical digital assets
    - Obtained additional technical details and clarifications on applicant's cyber security plan
  - Rule requirements were adequately addressed

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Chapter 9, Auxiliary Systems

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Purpose

- Provide a summary of the staff's evaluation of Chapter 9 of the Vogtle COL application
- Provide background information regarding the AP1000 design and the ESP as it relates to Chapter 9 of the application:
  - Content IBR from the design certification or the ESP without modification did not involve further technical review
  - Standard content for AP1000 design center reviewed for Vogtle as "Reference" COL application
  - Content specific to the Vogtle application

Information Incorporated by Reference from AP1000 DCD

- New fuel storage and handling
- Spent fuel storage and handling
- Water systems (e.g., CCW, SW)
- Process auxiliaries (e.g., CVCS, floor drainage system)
- Ventilation systems
- Fire protection, communications, lighting

Fuel Rack Structural Analysis

- Spent fuel rack design included in AP1000 amendment scope to resolve COL information item from initial certification
- Staff performed confirmatory structural dynamic and stress analyses based on the (auxiliary building) seismic loads transmitted to the racks
- Concluded that the DCD Revision 19 fuel rack designs are acceptable

Spent Fuel Pool Cooling

- Spent Fuel Pool (190,500 gallons of water)
- Active non-safety-related spent fuel pool cooling system
- Passive safety-related sources maintain the stored fuel in a submerged and cooled condition

Spent Fuel Criticality

- 889 Fuel Assembly Locations in 2 Regions
  - Both regions use Metamic™ to maintain margin to criticality
  - Region 2 (of the SFP) also uses burnup credit to maintain margin to criticality
  - Separate analysis with unborated water to verify fuel in pool remains subcritical

Overview of Vogtle COL FSAR Chapter 9

Section	Content	Topics of Interest
9.1 Fuel Storage and Handling	IBR/Standard	Metamic Coupon Monitoring Program
9.2 Water Systems	IBR/Plant-Specific	Raw Water System
9.3 Process Auxiliaries	IBR/Standard	
9.4 Air-conditioning, Heating, Cooling and Ventilation Systems	IBR/Standard	
9.5 Other Auxiliary Systems	IBR/Standard/ Plant-Specific	

Metamic Coupon Monitoring Program

- COL Information Item 9.1-7
  - Provide a Metamic coupon surveillance program for the spent fuel pool neutron absorbing material
- SNC described in the FSAR:
  - The methodology to be employed and the acceptance criteria
  - Corrective actions
  - Administrative controls
  - A commitment to implement the program before initial fuel load
- The staff found SNC's coupon monitoring program description to be acceptable and is proposing to include a license condition associated with the program's implementation

Raw Water System

- RWS design is outside the scope of the AP1000 certified design.
- Vogtle provided a site-specific RWS design which is non-safety-related and does not provide any safety-significant functions.
- RWS supplies water to:
  - Service Water System (SWS) cooling towers
  - Fire protection
  - Circulating Water System (CWS) cooling towers and pump cooling
  - Dilution water for radwaste discharge
  - Other users

Raw Water System (Cont'd)

- Staff reviewed the COL's FSAR and issued RAI with respect to:
  - General Design Criteria (GDC) 2, "Design Bases for Protection Against Natural Phenomena," and GDC 4, "Environmental and Dynamic Effects Design Bases" to ensure:
    - Failure of the RWS will not adversely affect the ability of other systems to perform their intended safety-significant functions

Raw Water System (Cont'd)

- Staff reviewed the COL's FSAR and issued RAI with respect to:
  - 10 CFR 20.1406, "Minimization of Contamination"
- Staff concluded that the RWS meets all applicable regulations

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Chapter 12, Radiation Protection

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Overview of Vogtle COL FSAR Chapter 12

Section	Content	Topics of interest
12.1 Assuring that Occupational Radiation Exposures are ALARA	Standard	
12.2 Radiation Sources	Standard/ Plant-Specific	
12.3 Radiation Protection Design Features	Standard/ Plant-Specific	• Minimization of Contamination
12.4 Dose Assessment	Standard/ Plant-Specific/ ESP	• Radiation Exposure to Vogtle Units 3 and 4 Construction Workers
12.5 Health Physics Facility Design	Standard/ Plant-Specific	

Minimization of Contamination

- **Issue:**
  - The Vogtle applicant needed to demonstrate compliance with 10 CFR 20.1406, Minimization of Contamination.
- **Resolution:**
  - SNC revised the FSAR to adopt NEI 08-08A, Generic FSAR Template Guidance for Life Cycle Minimization of Contamination.
  - SNC also provided site-specific information on how the exterior radioactive waste discharge piping was designed to control the release of radioactivity.
  - Staff review concluded that the applicant has provided acceptable operational programs (as described in NEI 08-08A) and site-specific information for the minimization of contamination which incorporates the guidance of RG 4.21 and demonstrates compliance with 10 CFR 20.1406.

Radiation Exposure to Vogtle Units 3 and 4 Construction Workers

- **Issue:**
  - The Vogtle applicant was requested to describe the expected radiation exposure to the Vogtle Units 3 and 4 construction workers from all radiation sources during construction and why these dose estimates comply with 10 CFR 20.1301 dose limits for individual members of the public.

- **Resolution:**
  - SNC revised the FSAR to address conduct of surveys in uncontrolled and restricted areas to demonstrate compliance with 10 CFR 20.1301
  - SNC provided additional information:
    - Dosimeter data (TLD) for direct radiation from existing Vogtle Units 1 and 2
    - Estimates of direct radiation exposures resulting from planned ISFSI
    - Estimates of direct radiation exposures resulting from future Vogtle Units 3 and 4
    - Estimates of exposures resulting from Vogtle Units 1, 2, and 3 gaseous and liquid effluents
  - Staff's review concluded that the applicant has estimated the dose to the Vogtle Units 3 and 4 construction workers and provided for the conduct of surveys to demonstrate compliance with 10 CFR 20.1301.

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Chapter 14, Initial Test Program and ITAAC-Design Certification

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Overview of Vogtle COL FSAR Chapter 14

Section	Content	Topics of Interest
14.1 Specific information to be included in final safety analysis reports	IBR	
14.2 Specific information to be included in standard safety analysis report	Standard	First-Plant-Only and First-Three-Plant-Only Tests
14.3 Certified Design Material	Standard/ Plant-Specific	

First-Plant-Only-Tests

- First-plant-only tests are special prototypical tests that establish performance parameters of unique design features of the AP1000 standard design
- Because of standardization of the AP1000 design, these special tests are not required on subsequent plants
- Some of these tests are conducted post-fuel load and their successful execution and completion are required by license conditions
- There are seven (7) tests

First-Plant-Only-Tests

- Pre-operational tests:
  - In-Containment Refueling Water Storage Tank Heatup
  - Pressurizer Surge Line Stratification Evaluation
  - Reactor Vessel Internals Vibration Testing
- Initial Criticality and Low Power Testing
  - Natural Circulation Tests
  - Passive Residual Heat Removal Heat Exchanger
- Power Ascension Testing
  - Rod Cluster Control Assembly Out of Bank Measurements
  - Load Follow Demonstration

First-Three-Plant-Only-Tests

- Special tests that affirm consistency of AP1000 passive system performance and behavior prior to allowing subsequent COL holder(s) to omit performance of the test
- There are two (2) first-three-plant-only tests:
  - Core Makeup Tank Heated Recirculation Tests
  - Automatic Depressurization System Blowdown Test
- Both tests are conducted prior to fuel load and their successful execution and completion are required by license conditions

Acronyms

ACRS – Advisory Committee on Reactor Safeguards
CCW – Component Cooling Water
COL – Combined License
CSA – Control Support Area
CSC – Communication Support Center
CVCS – Chemical Volume Control System
CWS – Circulating Water System
DC – Design Certification
DCD – Design Control Document
DEP – Departure
DHS – Department of Homeland Security
EAL – Emergency Action Levels
EOF – Emergency Operations Facility
EP – Emergency Plan(ning)
EIP – Emergency Implementing Procedures
ESP – Early Site Permit
FEMA – Federal Emergency Management Agency
FERC – Federal Energy Regulatory Commission
FSAR – Final Safety Analysis Report
GDC – General Design Criteria
IBR – Incorporated by Reference
ITAAC – Inspections, Tests, Analyses, and Acceptance Criteria
LWA – Limited Work Authorization
NEI – Nuclear Energy Institute
NERC – North American Electrical Reliability Corporation
NIST – National Institute of Standards and Technology
NSIR – Office of Nuclear Security and Incident Response
QA – Quality Assurance
RAI – Request for Additional Information
RCOL – Reference Combined License
RG – Regulatory Guide
RWS – Raw Water System
SWS – Service Water System
SCOL – Subsequent Combined License
(F)SER – (Final) Safety Evaluation Report
SNC – Southern Nuclear Operating Company
SNM – Special Nuclear Material
TSC – Technical Support Center
VAR – Variance
VEGP – Vogtle Electric Generating Plant
10 CFR –Title 10 of the Code of Federal Regulations