NRC FORM 658
(9-1999)

U.S. NUCLEAR REGULATORY COMMISSION

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DATE OF MEETING

12/10/2002

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Docket Number(s)	**50-269, 50-270, AND 50-287**
Plant/Facility Name	**OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3**
TAC Number(s) (if available)	**MB5361, MB5362, AND MB5363**
Reference Meeting Notice	**NOVEMBER 26, 2002**
Purpose of Meeting (copy from meeting notice)	**TO DISCUSS THE 6/7/02 SUBMITTAL ON TORNADO MITIGATION**

NAME OF PERSON WHO ISSUED MEETING NOTICE	TITLE
L. N. OLSHAN	**PROJECT MANAGER**

OFFICE

NRR

DIVISION

DLPM

BRANCH

PD II-1

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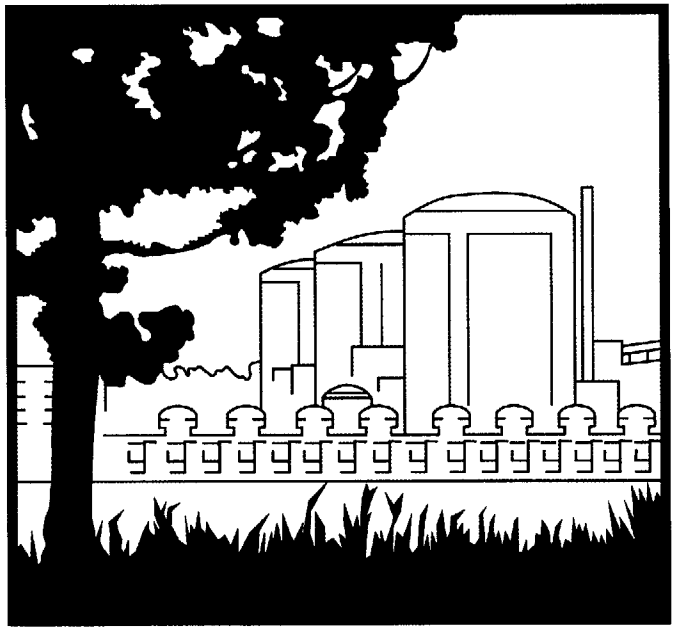
Duke Energy SM



Oconee Nuclear Station
Tornado License Amendment Request Meeting

December 10, 2002

Duke Energy SM

Oconee Nuclear Station Tornado License Amendment Request Meeting

- Meeting Objectives
  - Respond to Staff's Questions from Duke's Tornado Licensing Amendment Request dated June 7, 2002.
  - To obtain Staff concurrence on responses to these questions as well as any follow-up questions.
  - To determine those questions that may require a formal response via NRC RAI.

Duke Energy SM

Oconee Nuclear Station Tornado License Amendment Request Meeting

■Recap of proposed LB changes:

➢Revise UFSAR Section 3.2.2, Item 4 ("Tornado") in its entirety

- SFP-HPI flow path will be removed
- The SSF will be credited as the assured means of safe shutdown following the design basis tornado.

Oconee Nuclear Station
Tornado License Amendment Request Meeting

Recap of Tornado PRA evaluation results (from LAR)

TORNADO LAR CORE DAMAGE FREQUENCY RESULTS

Tornado CDF	UNIT 1	UNIT 2	UNIT 3
CDF from Updated PRA Model	$2.41E^{-5}$	$2.13E^{-5}$	$2.07E^{-5}$
CDF with Proposed Changes	$2.02E^{-5}$	$2.02E^{-5}$	$1.99E^{-5}$
Total Tornado CDF Change	$-3.9E^{-6}$	$-1.1E^{-6}$	$-8.0E^{-7}$
Individual CDF contribution Due to Proposed Changes			
Removal of SFP-HPI Flow path	$3.0E^{-7}$	$3.0E^{-7}$	$6.0E^{-7}$
Hardening WP/CD Room Walls	$-1.4E^{-6}$	$-1.4E^{-6}$	$-1.4E^{-6}$
Reactor Coolant Pump Seal Replacement	$-2.8E^{-6}$	n/a	n/a

QUESTION 1

The submittal is risk informed but proposes to establish a deterministic success path. A probabilistic treatment of tornado wind loading appears inconsistent with regulatory guidance (meeting current regulations) Standard Review Plan 3.3.2, 3.5.1.4, 3.5.2, RG 1.117, 1.176 and GDC-2 and 4. Although risk insights are referenced, it is not clear that the proposed or current tornado license bases change meets NRC regulations or guidance for tornado wind loads or that RG 1.174 criterion that states the proposed change meets current regulations is met. For example:

- UFSAR 3.3 states all class 1 structures, except those not exposed to wind are designed to withstand the effects of wind and tornado loadings.
- UFSAR 3.5.1.3 states that tornado generated missiles neither penetrate the reactor building wall nor endanger the structural integrity of the reactor building or any components of the reactor coolant system.
- UFSAR 3.1.2 states that systems or components which are essential to the prevention of accidents which could effect the public health and safety or the mitigation of their consequences shall be designed, fabricated and erected to performance standards that will enable the facility to withstand, without loss of capability to protect the public, additional forces that might be imposed by natural phenomena (including tornadoes). The designs are based upon the most severe natural phenomena recorded for the vicinity of the site. Among the essential components listed are:
    - Reactor coolant system
    - Engineered safeguard system
    - Electric emergency power sources
- UFSAR 9.6 notes that the SSF is a backup to existing safety systems, therefore the single failure criterion is not required. However, the proposed amendment states that the SSF is the assured deterministic path for tornado mitigation not a backup system.

The NRC SER on tornado missiles, dated July 28, 1989, states acceptance criteria that the probability of a loss of secondary heat removal capability by the EFW system due to tornado missiles not exceed 1E-6. For the proposed Oconee design, what is the probability of a loss of secondary decay heat removal capability due to tornado missiles?

RESPONSE

- Design Criteria for ONS developed in consideration of 70 GDC for Nuclear Power Plant Construction Permits proposed by AEC, in a proposed rulemaking published for 10CFR50 in July 11, 1967.

- Criterion 2, "Performance Standards"

  - Original LB relied upon Station ASW.
  - Principles for Tornado LB were protection or physical separation as evidenced by layout of Station ASW.
  - AEC accepted this philosophy for this criterion.
- Missiles will not penetrate the Reactor Building
- Plant Safety improved.
  - SSF fully protected from tornadoes.
  - Design bases of SSF exceeds that of Station ASW.
  - Reliance on Station ASW eliminated.
- Loss of SSDHR due to tornado missiles is eliminated.
  - Modifications to install missile barriers.
  - SSF ASW and vital support systems protected.

QUESTION 2

Provide the bases as to why single failures need not be considered/postulated for the Oconee tornado-licensing basis? Provide background information and references for the proposed change to the Oconee design basis such that the postulation of a single failure for a tornado event to the UFSAR is not required.

RESPONSE

- Original licensing basis did not postulate single failure
  - One Station ASW pump powered from single power source (1C.2.4 of original UFSAR)
- Post-TMI correspondence did not alter single failure requirements
  - Acknowledged that EFW was not tornado protected
  - Recommendation GL-4 established requirement to either fully protect SSF or analyze use of Station ASW; neither option is single failure proof (NRC SER dtd 2/9/82)

QUESTION 3

The Rev. 3 tornado analysis assumes the BWST is capable of withstanding tornado design basis wind loads. Describe the differences in the Rev. 3 analysis, vendor information or assumptions with respect to previous tornado analyses that assumed failure of the BWST due to tornado wind loading. Previous analyses assumed failure of structures due to wind loading were the dominant failure modes and as such, tornado missiles were not specifically modeled in the Oconee PRA. Discuss the analysis, data and the impact (delta CDF), including failure frequency, with the respect to BWST failure due to tornado wind loads and missiles as revised by the Rev. 3 tornado analysis.

RESPONSE

- Original BWST capacity in PRA based on 1982 scoping evaluation.
- Safety related calculation completed in 2002.
- BWST can withstand 300 mph wind load and 3 psi DP.
- BWST not designed to withstand tornado missiles.
- Rev. 3 BWST missile failure probability updated to correct Rev. 2 deficiencies
- TORMIS used to estimate BWST failure probabilities due to missiles.

Oconee BWST Failure Frequency

		BWST Conditional Failure Probability		BWST Damage Frequency		
F-Scale	Strike Freq.	Rev. 2 (based on WIND)	Rev. 3 (based on MISSILES)	Rev. 2 (based on WIND)	Rev. 3 (based on MISSILES)	% *Increase*
F-2	5.37E-05	-	0.071	-	3.81E-06	*32.4%*
F-3	4.12E-05	0.13	0.166	5.36E-06	6.84E-06	*12.6%*
F-4	3.59E-05	0.17	0.316	6.10E-06	1.13E-05	*44.6%*
F-5	1.71E-06	0.17	0.439	2.91E-07	7.51E-07	*3.9%*
			Totals	1.17E-05	2.27E-05	*93.6%*

QUESTION 4

Describe the modifications proposed for hardening the west penetration room and cask wash down areas against tornado wind loads and missile strikes.

RESPONSE

- Steel barrier system providing full protection from pressure differential, wind and missiles.
  - Steel panels added to West Penetration and Cask Decontamination Rooms.
  - Upgrade SSF trench, diesel fuel oil vent lines, and access doors to SSF.

QUESTION 5

The SSF is stated to be able to provide reactor coolant makeup and seal water for up to 72 hours. Is the SSF RCS makeup flow and supply adequate with RCP seal failures present?

RESPONSE

- SSF mission is to prevent RCP seal failure (29gpm).
- SSF RC makeup inventory sufficient for 72 hours.

QUESTION 6

The submittal states that the SSF is monitored through the maintenance rule program. Provide a scope of SSF systems that are included in the performance monitoring and surveillance requirements. Systems discussed should include those SSF systems required for tornado mitigation including HVAC, diesel fuel system, diesel cooling, batteries, charger, instrumentation, etc.

RESPONSE

- All SSF systems, including support systems, are included in the maintenance rule program.

QUESTION 7

What SSF components are controlled through the Oconee TS?

RESPONSE

- SSF Systems in TS
  - Power and Instrumentation.
  - ASW System.
  - RCMU System.
  - Portable Pumping System.
  - Battery Cells.
  - Fuel Oil Testing Program.

QUESTION 8

Provide the frequency of occurrence for tornadoes F-1 through F-5 assumed in the current Oconee PRA Rev. 3.

RESPONSE

F-Scale	Strike Frequency
F-2	5.37E-05
F-3	4.12E-05
F-4	3.59E-05
F-5	1.71E-06

QUESTION 9

Provide a discussion on the vulnerability of instrumentation/control systems/ displays for equipment required to mitigate the effects of a tornado strike. Discussion should include cables. Sensors (level, pressure), process equipment, power supplies including batteries and displays vulnerable to a tornado strike.

RESPONSE

- Instrumentation and Control Vulnerable Areas
  - West Penetration Room (important).
  - East Penetration Room (important).
  - Control Battery Room (not important / subordinate to EPR failure).
- Automatic I&C backup power supply adjacent unit is an important feature.
- Loss of Essential Auxiliary (4kV) Power will result in loss of all battery charger and eventual loss of all I&C power.

QUESTION 10

Discuss why the failures of the east and west penetration rooms appear to be considered independent for tornado winds and missiles.

RESPONSE

- Fault tree logic modified in Rev. 3 to reflect conservative assumption that room failures are completely dependent.

QUESTION 11

For the SSF RCMU system - does each unit have its' own pump?

RESPONSE

- Yes, each unit has its own RCMU pump.

QUESTION 12

Include any other areas in which operators actions may be needed to mitigate the consequences of a tornado (e.g., to align alternate power to an HPI pump from the station ASW switchgear, operators must open a normal power supply breaker in the turbine building or in the blockhouse next to the turbine building. Also describe operator's actions that may be required in the west penetration room to support station ASW or EFW operation.)

RESPONSE

- Operator Actions
  1. Reduced.
  2. Flow path alignment of HPI pump to SFP eliminated.
- Classifications (and Operator Actions)
  1. Tornado Warning
     - 1st floor AB
     - SSF
  2. Tornado Strike
     - Loss-of-power
       - TB basement - EFW
       - TB 5th floor - ADVs
       - East and West Pen. Rooms - Station ASW
       - TB 3rd floor or block house - 4kV Bkrs
       - 1st floor AB - HPI cables
       - East Pen Room - HPI valve

QUESTION 13

Although damage to control room equipment is not postulated with the failure of the control room wall during a tornado event no discussion on operator injury or human factor considerations or subsequent tornado missile or water damage is provided.

RESPONSE

- Unit 3 CR North Wall Damage Not An Important Failure Mode For PRA Analysis
  - Low probability of tornado missile or water damage based on qualitative evaluation
  - Important CR areas are not next to these walls.
  - SSF completely independent of CR

QUESTION 14

The submittal states that there is currently adequate staffing to align station ASW to a single unit's steam generators in 40 minutes. Discuss procedure revisions, staffing revisions, or other means that have been implemented by Oconee to ensure that the 40-minute time frame is met. Provide a discussion on the apparent design basis change that the station ASW pump provides secondary side heat removal for only a single unit during a tornado event instead of all units simultaneously.

RESPONSE

- Integrated validations to align Station ASW within 40 minutes [Subsequent confirmation by NRC inspection]
- ONS LB has traditionally assumed tornado damage to a single unit with a LOOP on all three units.
- Protected SSF provides deterministic capability to remove decay heat from all 3 units.

QUESTION 15

The submittal states that the upper surge tanks can withstand wind loadings associated with a 300 mph tornado. Earlier PRA analyses assumed damage to the upper surge tanks due to tornado wind loads. Describe any changes in the analysis or surge tank installation that significantly reduced the likelihood of upper surge tank failure. Include a discussion on the vulnerability of the upper surge tank to tornado missiles. Discuss the analysis, data and the impact (delta CDF), including failure frequency, with the respect to UST failure due to tornado wind loads and missiles as revised by the Rev. 3 tornado analysis.

RESPONSE

- Original PRA assumption based on engineering judgment.
  - No detailed wind analysis for UST but assumed to represent loss of EFW suction source.
- Revision 3 to PRA
  - Detailed wind analysis performed for UST and piping.
  - Failure probability for loss of suction similar to Rev.2
  - Set of events for tornado missile damage added.
  - Dominate failure mode is EFW run failure.
  - Overall impact of model changes is a CDF reduction.

QUESTION 16

Note that the analysis provides for realignment of the HPI system to the station ASW switchgear. Can this be accomplished in the required time assuming that station ASW is to be realigned as well? Have procedures and operator training been completed?

RESPONSE

- HPI flow needed 9 hours after tornado.
- Operators & maintenance dispatched within first hour.
- Validation confirmed power realignment

- Procedures & training established.

QUESTION 17

How long will station vital batteries support instrumentation and control functions following an assumed loss of 4kV power to all three units during a tornado event.

RESPONSE

- Each unit's vital batteries are sized to last 4 hours following SBO
- Operators shed non-essential loads within 30 minutes

QUESTION 18

The values shown in Table 1 of the submittal are in what units (/yr)?

RESPONSE

- Units are on a "per reactor-year" basis.

QUESTION 19

Have the results of the Oconee PRA peer review been evaluated against the proposed tornado license bases changes? Describe the changes incorporated into the proposed tornado license bases change as a result of this review.

RESPONES

- The peer review conducted through the B&WOG did not specifically review the tornado analysis or any other external events analysis; however relevant modeling issues were reviewed.
- There were no comments or findings from this review that would have any significant impact on the tornado model.
- In addition, independent consultant review was conducted; no issues identified.

QUESTION 20

Describe dependencies on "piggy back" cooling during tornado event mitigation.

RESPONSE

- Sump recirculation is modeled in the PRA tornado analysis as dependent on 4kV power.

- For loss of 4kV power, conserving and refilling the BWST is necessary to maintain core cooling following seal LOCA

QUESTION 21

Rev. 2 to the Oconee PRA states that for Unit 2 and 3 seal packages the analysis assumes that component cooling water through the RCP thermal barrier coolers is sufficient to continue RCP seal cooling following a loss of HPI. This assumption seems to be based on the RCP recirculation impeller operating. Is this assumption true with the pump tripped and the recirculation impeller inoperable? Are the same assumptions made for Unit 1 when modified with Sulzer seal packages?

RESPONSE

- RCP thermal barriers not credited in tornado analysis.
- Tornado accident sequences include a loss of normal 4kV power which would result in loss of power to LPSW pumps and CC pumps.

QUESTION 22

On page 11 of the submittal it is stated that the loss of 4Kv power will fail LPSW. Is this station 4Kv power? Provide clarification.

RESPONSE

- LPSW pumps are powered from essential 4kV Buses.
- During LOOP, Standby buses can supply essential Buses via MFB.

QUESTION 23

The station ASW reliability was stated to be adjusted to reflect the need to access components in the east penetration room. Since the east penetration room wall is likely to fail with the west penetration room how is access accomplished or quantified?

RESPONSE

- Human reliability assessment for station ASW alignment was adjusted to account for ADV accessibility and other factors involved in feeding both SGs in 40 minutes.
- The PRA assumes damage to either penetration room fails station ASW.

QUESTION 24

Is the Oconee PRA Rev. 3 completed - if not what is the schedule?

RESPONSE

- Level 1 analysis scheduled for completion in early 2003.

QUESTION 25

Oconee UFSAR Section 9.6, "Standby Shutdown Facility", does not state or credit the SSF as a backup facility for tornado mitigation (fire, sabotage, or flooding are referenced). No revision is proposed in the amendment request.

RESPONSE

- UFSAR will be updated to reflect role of SSF for tornado mitigation.

QUESTION 26

The submittal discusses the loss of offsite power to all 3 Oconee units with a high conditional probability that instrumentation power will be lost. The PRA includes this in run time failures for ASW and EFW. Why was the loss of instrumentation power not modeled as recovery of offsite power or recovery of instrumentation power within the required time frame?

RESPONSE

- Off-site power not recoverable in time to prevent core damage.
- Station battery chargers left without power if emergency power system fails.
- SSF has independent set of instrumentation and power supplies.
- SSF fails to provide SSDHR
  - Not credited with providing alternate control indication EFW or station ASW.
- No available means to reliably recover I&C power.

QUESTION 27

The submittal states that Oconee participated in the BWOG PRA certification program (May 7-11, 2001). Has the final report been completed? Confirm the version of the Oconee PRA reviewed and whether the revised tornado analysis included in the submittal was included in the review.

RESPONSE

- Final report completed September 2001.
  - Mix of Revision 2 and 3 PRA.
  - External Events not included.

QUESTION 28

Describe the 4 peer review findings received by Oconee during the BWOG peer review that were classified as "important and necessary" to address to ensure the technical adequacy of the PRA, the quality of the PRA, or the quality of the PRA update process.

RESPONSE

- Evaluation of dependence among human actions.
- Estimation of ISLOCA frequency.
- Key contributions to LERF potentially underestimated.
- Missing Common Cause Component Groups.

QUESTION 29

For a Tier 2 analysis RG 1.174 states that the licensee should provide reasonable assurance that risk-significant plant equipment outage configurations will not occur when specific plant equipment is out of service. Although changes to equipment surveillance intervals or completion times are not requested, the proposed licensing basis revisions should be evaluated with respect to potential risk significant outage configurations and any applicable restrictions. Provide a discussion on any restrictions found as a result of the proposed tornado license bases change (SSF or Keowee maintenance schedules and severe weather forecast for example).

RESPONSE

- ORAM-Sentinel model to be updated upon completion of Rev 3.
- No significant change to current configuration risk management program.
- Current model is very restrictive.

QUESTION 30

The ORAM-SENTINEL model used at Oconee is stated to utilize the full Oconee Rev. 2 PRA along with traditional deterministic methods. Confirm the applicability of the Rev.

2 model to accurately reflect the risk associated work activities involving equipment associated with the proposed licensing basis change and the revised tornado PRA model.

RESPONSE

- See Q29.

QUESTION 31

How long will the SSF diesel generator operate off the SSF day tank supply before the day tank supply is exhausted?

RESPONSE

- 200 gallon day tank will last about 48 minutes.
- 72-hour supply available in underground fuel oil storage tank.

QUESTION 32

Provide summary report for Rev. 3 of the Oconee tornado analysis. Specifically, provide information and analysis insights (equipment, procedures, or manual actions for example) that characterize the Rev. 3 Oconee baseline increase in tornado CDF.

RESPONSE

- Oconee PRA tornado model (Revision 3) core damage frequencies (CDFs):
    - Units 1/2 = 2.13E-05 /rx-yr
    - Unit 3 = 2.07E-05 /rx-yr
- Oconee PRA tornado model (Revision 2 - baseline) CDF = 1.4E-05. Higher CDF due to:
    - Additional logic for dependent failure mechanisms (spatial dependencies).
    - New failure modes associated with tornado damage around the U1/U2 blockhouse causing a loss of all 4kV power to all three units.
        - ⇒ In addition to the loss of normal power to ECCS and EFW systems, these failures can result in a loss of:
            - EFW Cooling Water
            - Makeup Capability To BWST
            - Vital I&C power (when vital batteries are depleted)

QUESTION 33

The vulnerability of the Keowee station is discussed in the summary report for the Rev. 2 Oconee PRA dated December 1996. The excitation and auxiliary power supplies are identified as the dominant tornado failure modes for Keowee.

Although the HPI (once aligned) and the station ASW pump do not rely on the 4160 V busses in the turbine building to mitigate a tornado event, the HPI and station ASW pump do rely on power from Keowee via the underground line. Discuss why the equipment identified as vulnerable at Keowee does not require tornado protection with respect to HPI and station ASW and the Oconee tornado design basis.

RESPONSE

- SSF as assured mitigation option provides separate power
- Tornado LB relied upon protection or physical separation.
- Six (6) sources of power available per original FSAR 1C.2.4
- KHU separation and underground path provides reasonable assurance that Station ASW would be available.