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DATE OF MEETING

08/26/2002

The attached document(s), which was/were handed out in this meeting, is/are to be placed in the public domain as soon as possible. The minutes of the meeting will be issued in the near future. Following are administrative details regarding this meeting:

Docket Number(s)	<u>50-269, 50-270, and 50-287</u>
Plant/Facility Name	<u>OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3</u>
TAC Number(s) (if available)	<u>MB5361, MB5362, MB5363, MB6144, MB6145, MB6146</u>
Reference Meeting Notice	<u>AUGUST 13, 2002</u>
Purpose of Meeting (copy from meeting notice)	<u>TO DISCUSS TORNADO MITIGATION, AUX BLDG. FLOODING, & EXTENSION OF KHU COMPLETION TIME</u>

NAME OF PERSON WHO ISSUED MEETING NOTICE

L. N. OLSHAN

TITLE

PROJECT MANAGER

OFFICE

NRR

DIVISION

DLPM

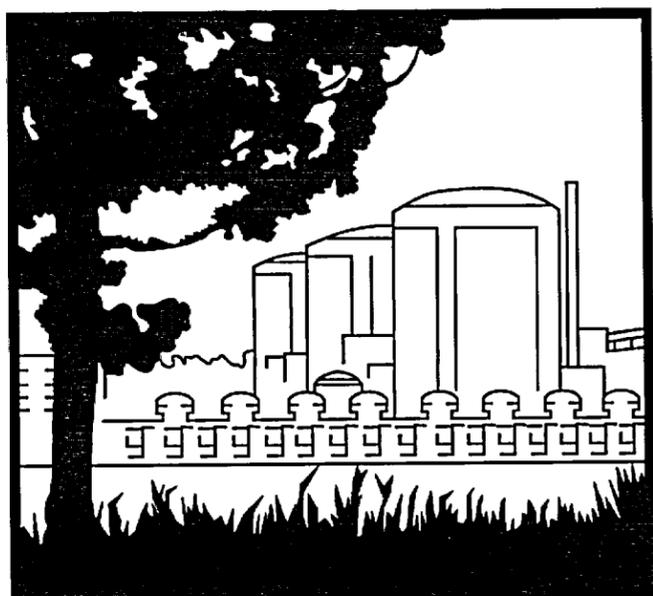
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PD II-1

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Oconee Nuclear Station
Tornado Licensing
Amendment Request
Meeting
August 26, 2002



Oconee Tornado License Amendment Request

■ Agenda

- Current tornado licensing basis (LB)
- Proposed changes to tornado licensing basis
- Risk Insights
- Conclusion

■ **Current Tornado Licensing Basis**

- Tornado mitigation strategy based on system diversity and risk insights
- Mitigating systems are not fully protected from tornado damage
- A tornado can not cause a loss-of-coolant accident
- Postulation of a single failure with a tornado event is not required
- Long standing assumption that a design basis (DB) tornado causes damage to single unit and results in a loss-of-offsite power for the station



Oconee Tornado License Amendment Request

■ Current Tornado Licensing Basis (continued)

- Systems that provide primary make-up and reactor coolant pump (RCP) seal cooling
 - Borated water storage tank (BWST) or spent fuel pool (SFP) to high pressure injection (HPI) pump
 - Standby Shutdown Facility (SSF) Reactor Coolant Makeup (RCMU) pumps
- Systems that provide secondary side heat (SSDH) removal
 - SSF ASW
 - Emergency Feedwater (EFW)
 - Station ASW
- Collectively, these systems provide reasonable assurance that safe shutdown can be achieved following a tornado



Oconee Tornado License Amendment Request

■ Proposed Changes to Oconee LB:

- Revise Section 3.2.2, Item 4 (“Tornado”) of the Updated Final Safety Analysis (UFSAR) in its entirety
 - UFSAR description of the SFP-HPI flow path will be removed
 - The SSF will be credited as the assured means of safe shutdown following the design basis tornado.

- Reasons for eliminating the SFP-HPI pump flow path:
 - Risk studies have shown that this function has low risk significance, is not reliable, and involves significant operator action outside the control room
 - An HPI pump depletes SFP inventory at a greater rate than a SSF RCMU pump

- Technical Justification for eliminating SFP-HPI flow path
 - BWST-HPI flow path is retained in UFSAR
 - Following modification to protect the SSF from tornadoes, the SSF RCMU pumps will provide an assured success path for makeup and seal cooling
 - A lower and more controlled SFP depletion rate using the SSF RCMU pump
 - Provides for quicker establishment of seal cooling that could prevent a seal failure.



Oconee Tornado License Amendment Request

- Technical Justification for crediting the SSF as the assured means of safe shutdown following the design basis tornado.
 - Once modification is implemented to protect the SSF from tornado damage, the SSF will provide an assured means of safely shutting down all 3 units following a design basis tornado
 - Defense-in-depth is improved
 - SSF system reliability and performance is fully monitored via
 - Technical Specifications
 - Selected Licensee Commitment Manual
 - Maintenance Rule
 - In-Service Testing program



Oconee Tornado License Amendment Request

■ Development of Risk Insights

➤ Tornado PRA upgraded to support Risk-Informed LAR submittal

- Reviewed major assumptions to ensure adequate detail and quality
- Incorporated changes and improvements for Oconee PRA Rev. 3 Update

■ PRA Improvements and Enhancements

- Multi-Unit Interactions And Dependencies
- Spatial Dependencies and Interactions
- Support System Dependencies
- BWST & Upper Surge Tank (UST) wind capacity analysis
- Other Improvements (RCP Seal Modeling, HRA, Instrumentation and Controls, T-H Analysis, etc.)

■ PRA Quality

- Normal PRA Internal Review Process
- Weekly Conference Calls
 - Discussion of Issues / Direction
 - Feedback on Assumptions / Approach
- Independent Outside Consultant Review
- Station Cross-Disciplinary Review



Oconee Tornado License Amendment Request

■ Plant Modifications

- ✓ ONS-1 RCP seal replacement
- ✓ Keowee Auxiliary Power Recovery Mod
(Addresses Switchgear 1TC Dependency)

❖ These modifications are included in the current CDF value.

Planned

- Fully tornado protecting the SSF (Commitment)

■ Current Oconee Tornado PRA Results

➤ Current Tornado CDF

- Units 1 & 2 = 2.13E-05 /yr (w/ updated U1 RCP Seals)
- Unit 3 = 2.07E-05 /yr

➤ Core Damage Sequences Dominated By:

- BWST / 4kV System Damage (WPR damage \geq F4)
- 4kV Power System Damage



Oconee Tornado License Amendment Request

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

■ Other Insights

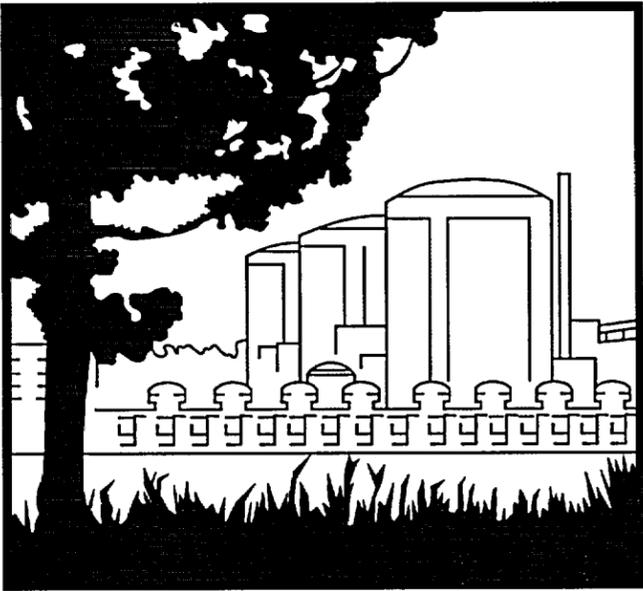
- The benefit of retaining the SFP-HPI suction flow path is very small.
 - Low SFP Suction Path Availability/Reliability
 - Alignment required when BWST damage occurs and SSF RC Makeup has failed.
 - BWST damage is accompanied by damage to other important plant systems (e.g., 4kV Power)

■ Other Insights (continued)

- Protecting the SSF systems has a greater benefit than the benefit of keeping the SFP-HPI suction alignment.
 - Unit 1&2 benefit is ~4.6 times higher.
 - Unit 3 benefit is ~2.3 times higher.
- The ONS-1 RCP seal replacement has had the highest benefit of all recent mods.

■ Conclusion

- The changes proposed are safe and result in an overall risk reduction at the station
- Once the modification to protect the SSF is complete, SSF ASW and the RCMU pumps become the assured flow path for SSDH removal and primary makeup respectively
- There are no new accidents or transients introduced by the elimination of the SFP-HPI flow path
- The changes proposed comply with the key principles set forth in RG 1.174.



Auxiliary Building Flooding
Licensing Amendment
Request

Oconee Nuclear Station
August 27, 2002



Auxiliary Building Flooding Licensing Amendment Request

Introduction

- Resolves non-conforming condition related to the impact of non-seismic piping failure in the Auxiliary Building (AB) on safety-related equipment
- Requests NRC to allow certain portions of the non-seismic piping in the Auxiliary Building to remain non-seismic based on low risk significance



Auxiliary Building Flooding Licensing Amendment Request

Overview

- ONS requirements for non-Category I piping in the AB established by 1972 AEC/Duke letters
- Oconee design basis review effort identified aspects of plant configuration and operation that are not in conformance with Duke's 10/24/72 response
- Duke to resolve non-conforming condition through a revision to the plant's licensing basis
- LAR proposes to change licensing basis to allow portions of non-seismic piping in the AB to remain non-Category I using the risk based approach guidelines of RG 1.174
- PRA concludes contribution to CDF for this piping being non-seismic versus seismic is an acceptable increase in risk



Auxiliary Building Flooding Licensing Amendment Request

Current Licensing Basis

- ONS licensing basis for LPSW and HPSW piping in the AB established in early 1970's.
 - September 26, 1972 AEC letter
 - October 24, 1972 Duke Response
 - AEC accepted Duke's response as noted in SER dated July 7, 1973



Auxiliary Building Flooding Licensing Amendment Request

Current Licensing Basis (cont.)

- September 26, 1972 AEC letter
 - Requested ONS to determine whether failure of any non-Category I equipment could result in flooding that could affect SR equipment
 - Letter prompted by the recent failure of an expansion bellows in a main condenser circulating water line at Quad-Cities



Auxiliary Building Flooding Licensing Amendment Request

Current Licensing Basis (cont.)

- **October 24, 1972 Duke Response**
 - AB could be subject to flooding from two sources:
HPSW & LPSW
 - HPSW not a flood threat since headers in the AB will be empty and dry except when manually energized to fight fire
 - LPSW not a flood threat due to flow limiting devices that would limit flood rate to a magnitude that could be detected and isolated prior to affecting S/R equipment



Auxiliary Building Flooding Licensing Amendment Request

Reconstitution of 1972 AEC Letter Requirements

- Duke reviewed AEC (NRC)/utility correspondence related to the September 26, 1972 letter
 - Utility responses primarily focused on the effects of flooding on S/R equipment.
 - Utility responses limited to non-seismic piping

- NRC expectations best described in a Safety Evaluation for another utility (and verbal conversations with other utilities)



Auxiliary Building Flooding Licensing Amendment Request

Description of Change

Revise UFSAR to indicate Duke evaluated the effects of flooding caused by the failure of non-seismic piping in the AB and determined that either:

- Flooding from failure of non safety-related piping in AB will not affect equipment required for safe shutdown or
- PRA concludes contribution to CDF for this piping being non-seismic versus seismic is an acceptable increase in risk.



Auxiliary Building Flooding Licensing Amendment Request

Justification for Change

- Increase in risk is acceptable per RG 1.174 guidance
- Mitigation capability of the SSF
- S/R equipment would remain available from a more likely crack failure scenario
- Industry data that shows steel piping is extremely resistant to damage by earthquakes several times larger than the Oconee SSE
- Walkdowns and ultrasonic tests provide high confidence that piping will remain intact after an SSE



Auxiliary Building Flooding Licensing Amendment Request

Plant changes to reduce flood risk

- AB flood procedure implemented to direct isolation of AB flooding sources
- Periodic ultrasonic inspections of HPSW and LPSW piping have been incorporated into Oconee's service water inspection program.
- Evaluating the use of flow limiting devices as a means of reducing flow rate from a postulated total rupture for certain systems
- Curbs installed to prevent water from entering the LPI hatch area.
- Hanger discrepancies identified during walkdowns being resolved
- Dividing wall penetrations between S/R pump rooms sealed to protect S/R equip. from moderate size flood (defense in depth measure)



Auxiliary Building Flooding Licensing Amendment Request

Effects on Safety

- Deterministic Evaluation
- Probabilistic Risk Assessment



Auxiliary Building Flooding Licensing Amendment Request

Deterministic Evaluation

- Non-seismic piping eliminated that were of a limited capacity or flow rate when assuming total rupture
- Non-seismic piping eliminated based on the demonstrated capability of an operator to successfully isolate the flooding source
- HPSW, LPSW and PDW were considered potential flooding sources that could not be isolated prior to affecting S/R equipment
- HPSW determined to be the bounding non-seismic flood source
 - Evaluation of a more credible crack in the 16" HPSW header concluded that the resulting flood can be successfully mitigated
 - Evaluation of the less likely total rupture of HPSW and LPSW piping concluded that the resulting flood would disable S/R equip required for safe shutdown



Auxiliary Building Flooding Licensing Amendment Request

Probabilistic Risk Assessment

- PRA Evaluation
 - AB seismic pipe break
 - Resulting flood incapacitates HPI Pumps
 - Unisolated, flood up to the level of CC MCCs
 - RCP Seal LOCA results
- SEISM used to convolve
 - Earthquake hazard curve
 - Pipe fragility curve (developed from ABS data)



Piping Evaluation

- Plant/system walkdowns
 - Screen piping and supports using seismic experience data
 - Identify controlling/bounding components
- Use analysis to evaluate “weak links”
- Develop bounding fragility numbers



Auxiliary Building Flooding Licensing Amendment Request

RG 1.174 Comparison

- Core damage frequency (Case 1-as constructed piping)
 - Seismic pipe break, seismic SSF failure
 - Seismic pipe break, random SSF failure

- Core damage frequency (Case 2- pipe fragility if it were analyzed, constructed and maintained as a “seismic” pipe)
 - Seismic pipe break, seismic SSF failure
 - Seismic pipe break, random SSF failure



Auxiliary Building Flooding Licensing Amendment Request

PRELIMINARY RESULTS

- PRA shows:
 - The risk from non-seismic piping in the AB is a small fraction of total seismic risk
 - If the pipe were upgraded to seismic, the reduction in risk would be small
- LERF is unaffected
- Shutdown Risk is low

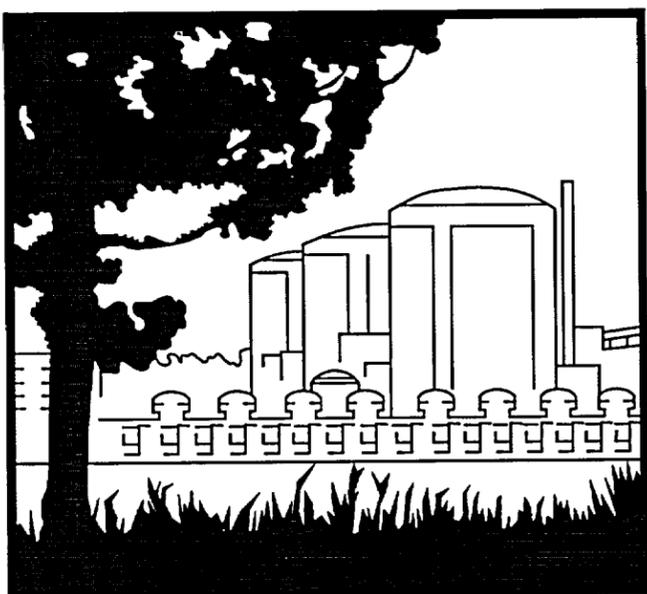


Auxiliary Building Flooding Licensing Amendment Request

Conclusion

- LAR provides appropriate deterministic and risk based justification for change

- Resolves non-conforming condition



LICENSE AMENDMENT
REQUEST TO SUPPORT KHU
UPGRADES

Oconee Nuclear Station
August 27, 2002



License Amendment Request to Support KHU Upgrades

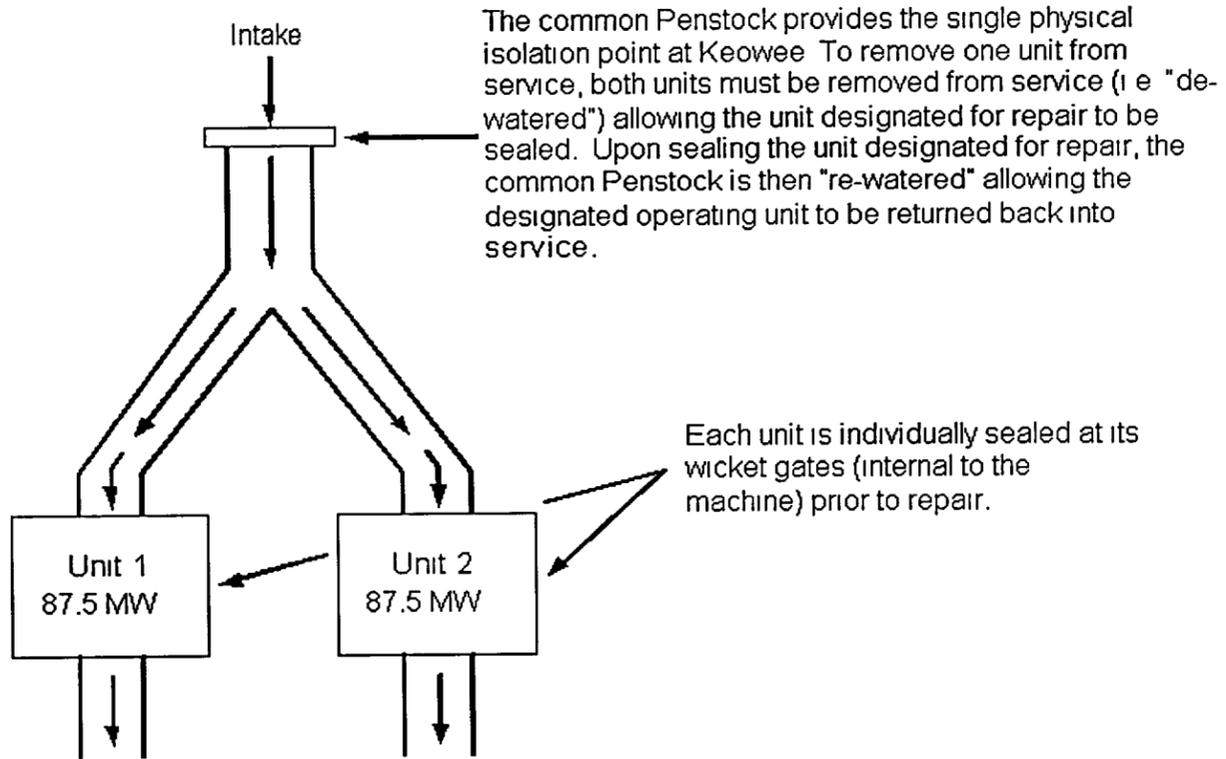
Introduction

- Keowee Hydro Units (KHU) being upgraded to ensure long-term KHU reliability

- Upgrades to include turbine weld repair, replacement of governor, exciter and batteries, out of tolerance modification, misc. turbine generator modifications

- Temporary License Amendment needed to allow necessary upgrades to proceed

Common Penstock





License Amendment Request to Support KHU Upgrades

License Amendment Request

- An additional 84 hours needed for dual KHU outage (TS 3.8.1 Required Action H.2 Completion Time)
- An additional 17 days desired for single KHU outage for contingency (TS 3.8.1 Required Action C.2.2.5 Completion Time)



License Amendment Request to Support KHU Upgrades

Need for dual KHU outage extension

- Lessons learned from similar work performed in 1979 & 1983 indicates that additional time needed to isolate KHU from common intake
- Dewatering needed to allow extensive weld repair of the turbine blades and discharge ring
- Isolation of KHU under repair needed to allow remaining KHU to be returned to service



License Amendment Request to Support KHU Upgrades

Need for single KHU outage extension

- Work window for all planned upgrades within the 45 day Completion Time of Tech Specs
- Several significant and complex upgrades being performed concurrently
- Additional time may be needed if problems arise in any one of these modifications
- 17 additional days desired as a contingency



Technical Justification

- Existing Comp Measures for extended single unit outage and planned dual unit outage

- Additional Compensatory Measures

- PRA Results



License Amendment Request to Support KHU Upgrades

Existing Tech Spec Compensatory Measures

- Lee Combustion Turbine energizing both Standby Buses
- LCOs for AC/DC Power Systems and Electrical Power Switching Logic (EPSL) must be met



License Amendment Request to Support KHU Upgrades

Additional Compensatory Measures

- No discretionary maintenance or testing will be performed on SSF, EFW or essential AC power system (e.g., main feeder buses, 4 kV switchgear, MCCs, etc.)
- Upgrades performed during periods when the expected frequency of LOOP events as a result of severe weather is low
- Operability of required offsite circuits will be maintained at all times.
- To the extent practical, maintenance and testing in the switchyard is to be scheduled outside the time period of the upgrade
- Upgrades performed under Critical Evolution process



PRA Methods for Temporary Change

- Risk impact evaluated using the most recent revision of the Oconee PRA (internal and external events)
- Risk impacts of the proposed changes calculated and compared against the acceptance guidelines of the EPRI PSA Applications Guide
- Risk impact is assessed as the change from the base CDF (nominal maintenance unavailabilities)



License Amendment Request to Support KHU Upgrades

Quantitative Analysis Considerations

- No discretionary maintenance or testing
 - SSF
 - EFW System
 - Essential ac power system (e.g., main feeder buses, 4 kV switchgear, MCCs, etc.)
- Reduced frequencies for tornado and severe weather related LOOPs as a result of scheduling work during favorable periods



Risk Assessment Results

- Cumulative Core Damage Probability (CDP) of 3.5E-06 is acceptable given actions to reduce potential for LOOP events and other compensatory actions.
 - Scheduling of work during favorable period
 - Restrictions on switchyard work during upgrade period



Risk Assessment Results (continued)

- Single KHU outage does not contribute to any increase in CDP as a result of elimination of discretionary maintenance during the upgrade period
- The increase in CDP occurs during the dual KHU outage periods



Risk Assessment Results (continued)

- Impact of Station Blackout expected to be as severe at shutdown as it is at power.
- Actual RCP seal performance may be better than assumed in the evaluation
- Independent Review of PRA confirmed results



License Amendment Request to Support KHU Upgrades

Risk Assessment Results (continued)

Maintenance Activity Time Period, days	Number of KHUs inoperable	Time Period (in excess of nominal TS), hours	Maintenance Activity Time Period CDP	Cumulative CDP
1- 6	2	84	2.84E-06	2.84E-06
7-51	1	144	-2.84E-07	2.56E-06
52-55	2	36	1.22E-06	3.78E-06
56-62	1	168	-3.31E-07	3.45E-06



License Amendment Request to Support KHU Upgrades

Conclusion

- Upgrades being done to improve long-term KHU reliability

- Temporary License Amendment needed to allow upgrades to proceed while at power

- Risk results support approval of the amendment