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PLUNKETT,T.F. Florida Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 93-001-01:on 930115,Westinghouse notified util that wet annular burnable absorber assemblies not mfg per design specs.Caused by failure to translate design requirement to drawing absorber design modified.W/930713 ltr.

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FPL

JUL 13 1993

L-93-169
10 CFR 50.73

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Re: Turkey Point Units 3 and 4
Docket No. 50-250 and 50-251
Reportable Event: 93-001-01
Date of event: January 15, 1993
Axially Mispositioned Wet Annular Burnable Absorber (WABA) Rods

The attached Supplement 1 to Licensee Event Report 250/93-001-00 is being provided, pursuant to the requirements of 10 CFR 50.73 to present the results of further analysis of this event.

Very truly yours,

T. F. Plunkett
Vice President
Turkey Point Nuclear

TFP/RJT/rt

Attachment

cc: S. D. Ebneter, Regional Administrator, Region II, USNRC
R. C. Butcher, Senior Resident Inspector, USNRC, Turkey Point

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Turkey Point Unit 3	05000250	1 OF 6

TITLE (4) Axially Mispositioned Wet Annular Burnable Absorber (WABA) Rods

EVENT DATE (5)			LER NUMBER(6)			RPT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MON	DAY	YR	YR	SEQ #	R#	MON	DAY	YR	FACILITY NAMES	DOCKET # (S)
1	15	93	93	001	01	7	13	93	TURKEY POINT UNIT 4	05000251

OPERATING MODE (9)	1	OTHER (Specify in Abstract below and in text) Voluntary
POWER LEVEL (10)	100	

LICENSEE CONTACT FOR THIS LER (12)

R. J. Tomonto, Licensing Engineer	TELEPHONE NUMBER: 305-246-7327

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	NPRDS?	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	NPRDS?

SUPPLEMENTAL REPORT EXPECTED (14) NO ☒ YES ☐	EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
(If yes, complete EXPECTED SUBMISSION DATE)				

ABSTRACT (16)

On January 14, 1993, with Turkey Point Units 3 and 4 in Mode 1 (POWER OPERATION) at 100% power, Florida Power and Light (FPL) was notified by Westinghouse Electric Corporation (nuclear fuel supplier) that the wet annular burnable absorber (WABA) assemblies were not manufactured according to the design specification. Both units were operating in Cycle 13. Specifically, beginning with Unit 3 Cycle 12 reload, FPL introduced a new fuel assembly design feature involving debris resistant fuel rods. The debris resistant design involved increasing the length of the solid fuel rod end cap and repositioning the active fuel height up 1.368 inches from the bottom of the fuel rod. The reload design for Unit 3 Cycle 13 and Unit 4 Cycle 13 required the absorber section of the WABAs be repositioned on center to match the corresponding repositioned active fuel height. During the startup of Turkey Point Unit 3 Cycle 13, FPL measured a higher local peaking factor (Fq) and a more top-peaked beginning of cycle axial power distribution than predicted by core models. As a result of further investigations, Westinghouse determined that the absorber section of the WABA had not been manufactured in accordance with design specification for the fuel reload.

At no point was either Unit 3 or Unit 4 operating in a condition outside of the design bases of the plants.

This LER is submitted as VOLUNTARY.

I. DESCRIPTION OF THE EVENT

The following chronology of events was developed.

12/29/92 Unit 3 was in Mode 1 at 100% Power (POWER OPERATION) and Unit 4 was in Mode 1 at 100% Power

Florida Power and Light (FPL) reviewed the Unit 3 flux map at 100% power (following the initial return to power after a refueling outage), equilibrium xenon, steady-state conditions and found an increase in local peaking factor (Fq), and a more top-peaked beginning of cycle (BOC) axial power distribution than predicted by core models.

12/30/92 through 1/13/93 FPL reviewed the INCORE-3D code and the trace alignment procedure. FPL investigated the possibility that the absorber section of the wet annular burnable absorber (WABA) rods (EIIS - AC) (IEEE-ABS) was not centered with the fuel assembly active fuel height.

1/14/93 Westinghouse confirmed that the WABA rods were not manufactured in accordance with design requirements. Westinghouse's calculations showed that the WABAs rods were offset -1.368" from the center of the active fuel.

1/15/93 Based on the preliminary results obtained from FPL and Westinghouse core models, and engineering judgement, it was determined that current operation for both units was acceptable. Westinghouse was directed to confirm this conclusion based on performing the Final Acceptance Criteria (FAC) analysis using as-built parameters. A satisfactory interim operability assessment was completed.

1/17/93 Westinghouse completed the FAC analysis using BOC operation data (rod position and power versus time). Westinghouse concluded from the FAC analysis that all operation for both units was bounded by the design basis for the entire fuel cycle.

FPL introduced a debris resistant fuel assembly (DRFA) (EIIS - AC) design beginning in Unit 3 Cycle 12 and continuing in Unit 4 Cycle 13 and Unit 3 Cycle 13 reloads. The DRFA design incorporates the following design features compared to the standard Westinghouse optimized fuel assembly (OFA) design:

- solid bottom fuel rod end plug was increased in length by approximately 1.381 inches,
- total fuel stack height remained unchanged (with the exception of the positioning within the fuel rod),
- fuel assembly spacer grids were repositioned, and
- guide tube dashpot was shortened and guide tube flow hole locations were changed, to accommodate the repositioning of the spacer grids.

The Westinghouse DRFA design is unique to Turkey Point and no other licensee using Westinghouse fuel has incorporated the same fuel assembly design. Other PWR fuel suppliers utilize this same design.

In Unit 3 Cycle 12 a study of the use of offset WABA's concluded that the effects of this offset was not significant. The presence of the offset WABA rods were not discernable during the Unit 3 Cycle 12 startup, since the number of WABA rods (96) did not significantly alter the expected performance of the core.

The Unit 4 Cycle 13 reload included the first Unit 4 batch of fuel with debris resistant fuel. The reload design included 368 WABA rods, distributed in 36 fuel assemblies. The largest number of WABA rods in an individual assembly was 20 rods. The location of the WABA assemblies within the core was evenly distributed across the core and exposed to an average power condition. A discrepancy in peaking factors was not observed in the Unit 4 Cycle 13 fluxmaps, since the number of WABA rods and their effect on axial flux shape did not significantly alter the expected performance of the core. The results of Westinghouse's FAC reanalysis concluded that the core limits were maintained (Fq) during the cycle with the offset WABAs and the offset WABAs did not compromise plant safety.

The Unit 3 Cycle 13 reload represented the second fuel region (in Unit 3) with debris resistant fuel. The reload design included 512 WABA rods, distributed in 28 fuel assemblies. The largest number of WABA rods in an individual assembly was 20 rods. The location of the WABA assemblies within the core was centered around the middle of the core, corresponding to the highest power density in the core. As highlighted above, FPL discovered, during the initial fluxmap at 100% power steady state conditions, a discrepancy between the predicted and measured total peaking factor (Fq). Subsequent investigation of the deviation led to the conclusion that the WABA rods were incorrectly positioned by -1.368 inches relative to the active fuel stack. A safety evaluation was performed to evaluate the acceptability of operation of both units for the remainder of these cycles (Unit 3 Cycle 13 and Unit 4 Cycle 13).

II. CAUSE OF THE EVENT

The root cause of this event was that Westinghouse failed to translate a specific design requirement for centering the WABAs to the fabrication drawing.

The following factors contributed to the event:

1. FPL correctly specified 0.0 inch WABA offset in the reload specification for Unit 3 Cycle 13 and Unit 4 Cycle 13 reload. However, FPL did not highlight this dimension as a change to Westinghouse.

2. Westinghouse performed an evaluation of the Unit 3 Cycle 12 reload with offset WABAs and concluded that the offset was not significant. This evaluation was later misinterpreted as a general design guideline.

3. The Westinghouse design review process failed to address the location of the WABAs as a design criterion.

III. ANALYSIS OF THE EVENT

A. Turkey Point Unit 4 Cycle 13 Operation

Turkey Point Unit 4 Cycle 13 reload design was evaluated using existing core design models with NRC approved methodology. These models were revised to account for the WABA offset and used to verify that the full cycle of operation was bounded by the existing Reload Safety Evaluation. This verification involved evaluating the impact of the WABA offset on the Cycle 13 Reload Safety Analysis Checklist (RSAC) parameters and on the axial power distribution analysis to determine the impact on Departure from Nucleate Boiling (DNB) and Fq.

The RSAC parameters represent a comparison of the nuclear design inputs to the safety analysis input. No accidents were required to be re-evaluated if the design inputs are bounded by the safety analysis inputs. The impact of the WABA offset on each of the Cycle 13 RSAC parameters was analyzed or assessed for its impact on the current RSAC. The nuclear design inputs for the WABA offset case were bounded by the current RSAC.

Axial power shapes were analyzed using the NRC approved Final Acceptance Criteria (FAC) methodology. This analysis was re-performed for the entire fuel cycle. For a variety of plant operational maneuvers, this analysis generates thousands of power shapes which represent a family of adverse xenon and power distributions which are possible during Condition I and Condition II events. The FAC re-analysis verified that Fq limits remained below the Technical Specification limits during all Mode 1 operation provided that axial flux distribution (AFD) and rod insertion limits are maintained within the limits allowed by the Technical Specifications.

In summary, all statements and conclusions presented in the original Reload Safety Evaluation (RSE) remain valid for the entire operating cycle. The Unit 4 Cycle 13 core design with offset WABAs meets all safety parameter limits, thereby ensuring that all pertinent design and licensing basis acceptance criteria are met.

B. Turkey Point Unit 3 Cycle 13 Operation

Similar to Unit 4, the Unit 3 Cycle 13 reload was evaluated using core models which were revised to account for the offset WABA. The RSAC parameter evaluation and FAC analysis were performed from 1000 Megawatt-days/Metric-ton Uranium (MWD/MTU) to the End of Cycle (EOC). The current burnup exceeds 1000 MWD/MTU. The nuclear design inputs for the WABA offset case were bounded by the current RSAC.

To ensure that Technical Specification compliance had been maintained for Unit 3 Cycle 13 from BOC to 1000 MWD/MTU, past operation data (i.e., actual power history and rod movement) was reviewed and modelled using an approved three-dimensional nuclear code. The analysis demonstrated that the Fq Technical Specification limit was not violated during actual operation and the plant was always within the design basis.

Within the conditions of the Technical Specification, the potential did exist that Unit 3 could have operated outside the design basis; however, at no point did either Turkey Point Units 3 or 4 operate outside their design bases.

C. Reportability Determination

Reportability was evaluated under 10 CFR 50.73 (a)(2). The event of the mispositioned WABA was originally reported under 10 CFR 50.73 (a)(2)(ii)(A). The details that follow will address the basis of the determination of a VOLUNTARY LER.

- 10 CFR 50.73 (a)(2)(ii)(A) states: Any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded, or that resulted in the nuclear power plant being in an unanalyzed condition that significantly compromised plant safety.

For both Unit 3 Cycle 13 and Unit 4 Cycle 13, the mispositioned WABA rods placed the units in an unanalyzed condition. Both Westinghouse and FPL recognize the fact that the nuclear design analysis and conclusions reached in the reload safety evaluations (RSE) for these cycles were based upon the burnable absorber section of the WABA rods being centered at the midplane of the active fuel. As a result, a change from this assumption, which in itself is less conservative, has placed this event in an unanalyzed condition.

The significance of this unanalyzed condition is evaluated by using the criteria that an unanalyzed condition that significantly compromises plant safety exists if (1) the condition potentially affecting a component, system, or structure is of more than minor safety significance; and (2) the condition potentially could (a) increase the probability of occurrence or the consequences of an accident or malfunction of equipment. Engineering judgment and experience may be used when evaluating the condition for reportability under this criteria.

FPL concluded that the mispositioned WABA rods were of minor safety significance for Unit 3 Cycle 13 (BOC to 1000 MWD/MTU), based on the following information:

- The results from the FAC analysis performed by Westinghouse concluded that Fq*K(z) could potentially have been violated by up to approximately 11% based on the WABA offset at approximately 10.6' of the active core height (maximum Fq of 2.425 at 10.6'), if the unit had operated in a load-follow mode with the worst combination of axial power shape and rod position.

- Based on an Fq of 2.425 and the Westinghouse Power Shapes Sensitivity Methodology (PSSM) for Loss of Coolant Accidents (LOCA), the Peak Clad Temperature (PCT) would have increased approximately 61°F from the current analysis. By FPL letter L-92-338, dated December 18, 1992, FPL submitted to the NRC a summary of the current analysis of record for Large Break LOCA of 2129°F. Therefore the PCT would have been approximately 2190°F (for this extreme case), which is less than the 10 CFR 50.46 (b)(1) criteria of 2200°F.

- The axial power shapes resulting from the mispositioned WABA for Unit 3 Cycle 13 from BOC to 1000 MWD/MTU are more limiting than those analyzed in the FAC analysis supporting the original reload safety evaluation. Westinghouse performed specific neutronic and thermal hydraulic calculations which confirm that the DNBR limit would not have been violated during the operation of Turkey Point Unit 3 Cycle 13, considering all possible power shapes that have occurred, or may occur, due to the mispositioned WABAs, throughout the cycle using the

Constant Axial Offset Control (CAOC) operating strategy.

Additionally, the non-LOCA analyses have been reanalyzed using the Revised Thermal Design Procedure (RTDP) which results in a DNBR margin of 19.6% for the optimized fuel assembly design. This additional margin can also accommodate any reduction in the DNBR due to the mispositioned WABAs. In the reanalyses of the non-LOCA events using RTDP, an Fq of 2.5 with a 5% flow reduction and $F_{\Delta H}$ of 1.70 were used. The current Fq and $F_{\Delta H}$ limits are 2.32 and 1.62, respectively.

For the Unit 3 Cycle 13 core design with offset WABAs, the analysis using actual plant operating history data and rod movement demonstrated that the Fq Technical Specification limit was not violated during actual operation at BOC (0 to 1000 MWD/MTU) and the plant was always within the design basis.

For the Unit 4 Cycle 13 core design with offset WABAs, the core design met all safety parameter limits, thereby ensuring that all pertinent design and licensing basis acceptance criteria are met.

In summary, at no point was either Unit 3 or Unit 4 operating in a condition outside of the design basis of the plant.

As a result, this LER is submitted as VOLUNTARY.

IV. CORRECTIVE ACTIONS

1. Westinghouse modified the design of the WABAs for Turkey Point Unit 4 Cycle 14 to correctly position the absorber section relative to the active fuel height.

2. FPL performed an oversight review to determine if the error in the Westinghouse fuel design process could have/should have been identified by the licensee. This oversight review included Engineering and Quality Assurance (QA) activities.

3. For each future reload, a Reload Oversight Plan will be prepared that reflects the physical and neutronic changes to the fuel for that cycle. This effort will be implemented beginning with the Unit 3, Cycle 14 reload.

4. FPL performed a review of the burnable absorber positioning at St. Lucie Units 1 and 2, to determine its applicability to other FPL nuclear fuel suppliers. No problem was identified.

5. FPL revised Nuclear Engineering quality instruction (JPN QI) 3.1.8, "Engineering Package (EP) for Fuel Reloads" to facilitate identification of changes to core components or core response.

V. ADDITIONAL INFORMATION

None.