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March 24, 1983

Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
101 Marietta Street NW, Suite 2900
Atlanta, Georgia 30303

Re: McGuire Nuclear Station Unit 1
Docket No. 50-369

Dear Mr. O'Reilly:

Please find attached Reportable Occurrence Report RO-369/83-11. This report concerns T.S.6.9.1.12(i), "Performance of structures, systems, or components that requires remedial action or corrective measures to prevent operation in a manner less conservative than assumed in the accident analysis report or Technical Specifications bases...". This incident was considered to be of no significance with respect to the health and safety of the public.

Note that inspection of the non-fuel bearing components is still in progress and therefore an accurate assessment of broken spring parts cannot presently be made. A follow-up report will be submitted to address this issue.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

PBN:jfw
Attachment

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

Mr. W. T. Orders
Senior Resident Inspector
McGuire Nuclear Station

Records Center
Institute of Nuclear Power Operations
1100 Circle 75 Parkway, Suite 1500
Atlanta, Georgia 30339

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DUKE POWER COMPANY
McGUIRE NUCLEAR STATION
REPORTABLE OCCURRENCE REPORT NO. 369/83-11

REPORT DATE: March 24, 1983

FACILITY: McGuire Unit 1, Cornelius, NC

IDENTIFICATION: Breaks Discovered in Non-Fuel Bearing Component Holddown Springs

DESCRIPTION: On March 10, 1983, during inspection of the fuel assemblies, the holddown spring for a Non-Fuel Bearing Component (NFBC) was observed to be broken. This discovery led to the inspection of all NFBC holddown assemblies for the Unit 1 core. Of the 94 NFBC's equipped with the same spring design, 21 were determined to be broken. Of these 21 broken springs, three were identified as having double fractures such that a semicircular spring section might move free of the yoke guide and into the flow of the coolant system.

No immediate corrective action was required, as the fuel assemblies had been removed from the core.

This incident is due to Design Deficiency, as the broken holddown springs are theorized to have resulted from fatigue failure.

EVALUATION: Prior to McGuire Unit 1 initial fuel loading, Westinghouse identified deficiencies in the design of holddown assembly springs of NFBC's (OHI Unit 1 had discovered breaks in NFBC holddown springs in April of 1980). The purpose of these springs is to hold the NFBC's (which include thimble plugs, burnable poison rods and sources) in the fuel assemblies, resisting the lifting force of reactor coolant flow. Experience at other plants had shown that springs identical to those at McGuire were prone to breakage in the first 3000 hours of operation. The close match of spring and reactor coolant pump resonances was theorized to be a contributing factor to the failures, as was poor spring heat-treating during manufacture. Another consideration was the barrel-shape of the spring, which placed the center coils further into the coolant flow path.

The analyses of that time indicated that single location fractures were the most likely failure mode within the first fuel cycle. This was not considered a safety concern. It was decided that old design springs in the NFBC holddown assemblies which were intended to remain in the core past the first cycle (thimble plugs and secondary sources) would be replaced with a new design.

These matters were previously addressed in Mr. W. O. Parker's November 18, 1980 letter to Mr. H. R. Denton (NRC/NRR) in which he responded to the NRC's earlier questions concerning the springs (letter from Mr. R. L. Tedesco (NRC/NRR) to Mr. W. O. Parker, dated October 8, 1980).

The new design holddown spring has a cylindrical outline and is tuned to a higher frequency. It was installed in the holddown assemblies of the 44 thimble plugs and 2 secondary sources. This modification (exchanging spring designs) was completed by October 1980.

Unit 1 has not been operated continuously at 100% full power due to problems with steam generator design. Operating at 50% of full power has allowed the holddown springs to undergo an equivalent full fuel cycle of stress (in hours) without having actually completed the cycle.

After discovering the broken springs in the holddown assembly of 21 NFBC's, an inspection was performed on the 46 new design springs used in the holddown assemblies of the thimble plugs and secondary sources. All of these springs were confirmed to be intact and undamaged.

CORRECTIVE ACTION: Upon notification of the broken springs, both Duke and Westinghouse began evaluation of alternate core designs which minimized or eliminated use of the defective holddown springs. A core design has been developed which reloads all fuel assemblies in their previous locations, replaces all burnable poison assemblies with thimble plugs, inserts two new secondary source assemblies, and reinserts the two secondary sources (each of which contain 16 partially depleted burnable poison rodlets). Therefore, all springs of the defective design have been removed from the core.

A reload type safety evaluation is being performed by Westinghouse to justify the modified core design. The purpose of this evaluation is to verify that the existing nuclear design/safety parameters input to the FSAR Chapter 15 safety analyses are still bounding. This evaluation is being performed utilizing the methodology contained in WCAP-9272 (Reload Safety Evaluation Methodology Topical). It is currently anticipated that this modification to the core design will be accomplished under the provisions of 10 CFR 50.59.

The primary consequences of the removal of old burnable poison rod assemblies are the potential extension of the first cycle, and the necessity of additional core physics testing during the upcoming start-up. After core reload the following physics tests are planned:

I. Core Loading

Core verification will be videotaped and checked in usual manner. This assures fuel, control rod, secondary source, and thimble plugs are properly located.

II. Hot Zero Power Tests

1. Isothermal Temperature Coefficient (ARO)
2. Flux Map (ARO)
3. Measurement of Control Rod Banks D and C in sequence using boration/dilution
4. ARO Cirtical boron concentration

III. 75% Power Tests

1. Incore/Excore calibration

2. Target Axial Flux Difference
3. Flux map

IV. 100% Power Tests

1. Target Axial Flux Difference
2. Power Coefficient (to satisfy original test program)
3. Flux map

SAFETY ANALYSIS: By replacing the NFBC's containing old-design holddown springs with thimble plug assemblies incorporating new design springs, the likelihood of spring failure will be significantly reduced.

Potential problems associated with springs in the holddown assemblies of NFBC's were thoroughly addressed in a Westinghouse analysis postulating effects of broken springs. Rodlet failure or thimble wear due to vibration of unrestrained assemblies, power distribution effects or bypass flow due to assembly lift, and reduction in Upper Head Injection inlet flow area were all determined to be negligible.

The potential for loose parts in the reactor coolant system was evaluated by Westinghouse based upon single fractures of springs. Past experience had shown this to be the only failure mode encountered. As Unit 1 was observed to have double fractures in the failed springs, these assumptions are not valid for this incident.

Three of the damaged springs were confirmed to have double breaks but all pieces were retained about the hub of the handling portion of the core component. No other damage or indications of adverse wear was observed. Westinghouse representatives have observed these assemblies and copies of TV tapes have been provided to them for their further investigation.

The inspection of NFBC's is still in progress (involving lifting the assemblies to allow better camera access to the bottom of the barrel-shaped springs) and an accurate assessment of broken spring parts cannot presently be made. A follow-up report will be submitted to address this issue.