May 6, 2002

Mr. William R. McCollum, Jr.
Vice President, Oconee Site
Duke Energy Corporation
7800 Rochester Highway
Seneca, SC 29672

SUBJECT: OCONEE NUCLEAR STATION, UNIT 3 RE: SAFETY EVALUATION OF RELIEF REQUEST ASSOCIATED WITH THE PUMP SPECIFIC RELIEF REQUEST NO. ON-SRP-HPI-02 (TAC NO. MB4456)

Dear Mr. McCollum:

By letter dated March 11, 2002, as supplemented by letter dated March 13, 2002, you requested relief from the vibration monitoring requirements for the standby shutdown facility (SSF) reactor coolant (RC) makeup pump. These requirements are specified in Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code.

We have concluded that compliance with the Code-required test for the SSF RC makeup pump would result in hardship without a compensating increase in the level of quality and safety. On this basis, your proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) until the next power reduction in which a repair or replacement of the sensor can be completed.

On March 12, 2002, we granted verbal approval of this relief request.

Sincerely,

/RA/

John A Nakoski, Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-269, 50-270, and 50-287

Enclosure: Safety Evaluation

cc w/encls: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO PUMP SPECIFIC RELIEF REQUEST NO. ON-SRP-HPI-02

DUKE POWER CORPORATION

OCONEE NUCLEAR STATION, UNIT 3

DOCKET NUMBERS 50-270 AND 50-287

1.0 INTRODUCTION

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a, requires that inservice testing (IST) of certain American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 pumps and valves be performed at 120-month IST program intervals in accordance with a specified ASME Code and applicable addenda, except where alternatives have been authorized or relief has been requested by the licensee and granted by the Nuclear Regulatory Commission (NRC) pursuant to paragraphs (a)(3)(i), (a)(3)(ii), or (f)(6)(i) of 10 CFR 50.55a. In accordance with 10 CFR 50.55a(f)(4)(ii), licensees are required to comply with the requirements of the latest edition and addenda of the ASME Code incorporated by reference in the regulations 12 months prior to the start of subsequent 120-month IST program intervals. Licensees whose IST program reaches its 120-month interval after September 22, 2000, are required to implement the 1995 Edition with the 1996 Addenda of the ASME Code for Operation and Maintenance of Nuclear Power Plants (ASME OM Code). In proposing alternatives or requesting relief, the licensee must demonstrate that (1) the proposed alternatives provide an acceptable level of quality and safety, (2) compliance would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety, or (3) conformance is impractical for the facility. 10 CFR 50.55a authorizes the NRC to approve alternatives to and grant relief from ASME Code requirements upon making the necessary findings. NRC guidance in Generic Letter (GL) 89-04, “Guidance on Developing Acceptable Inservice Testing Program,” provides acceptable alternatives to the Code requirements. Further guidance is given in GL 89-04, Supplement 1, and NUREG-1482, “Guidelines for Inservice Testing at Nuclear Power Plants.”

By letter dated March 11, 2002, as supplemented by letter dated March 13, 2002, Duke Energy Corporation (the licensee) submitted a relief request for vibration testing of the standby shutdown facility (SSF) reactor coolant (RC) makeup pump at Oconee Nuclear Station, Unit 3.

Oconee Nuclear Station, Unit 3 is currently in its third interval. The ISI program for this interval was developed in accordance with the requirements of the ASME *Code*, Section XI, 1986 Edition.

2.0 RELIEF REQUEST FOR SSF RC MAKEUP PUMP

The licensee requested relief for the SSF RC makeup pump vibration monitoring requirements of paragraph IWP-4510 of the 1986 Edition of the ASME Code, Section XI. Concerning

placement of the vibration sensor (probe) on pumps, paragraph IWP-4510 states “On reciprocating pumps, the location [of the probe] shall be on the bearing housing of the main pump drive shaft, approximately perpendicular to both the shaft and the line of plunger travel.”

2.1 Licensee’s Basis for Requesting Relief (as stated)

> During an accident, the SSF RC Makeup pump takes suction from the spent fuel pool and injects into the reactor coolant pump (RCP) seals. During accident conditions, the SSF RC Makeup pump would be required to inject flow into the RCP seals at 2350 psig. The SSF RC Makeup pump is tested during power operation through a recirculation test flow path that takes suction from the spent fuel pool and returns to the spent fuel pool.
>
> The SSF RC Makeup pump is a positive displacement pump located within the containment building. Quarterly vibration parameters are monitored via permanently installed vibration sensors that are routed through a containment penetration. Two vibration sensors (accelerometers) are mounted on the pump bearing housings. The pump outboard bearing probe is in the vertical direction (perpendicular to the crankshaft and perpendicular to the line of plunger travel) and the pump inboard probe is in the horizontal direction (perpendicular to the crankshaft and parallel to the line of plunger travel).
>
> Currently, the pump outboard vibration probe is not functioning properly such that valid data is unobtainable from this instrument. During an extended pump run on 3/8/02, the pump outboard bearing vertical vibration was observed to be responding erratically. After a detailed engineering analysis of the vibration data, it was concluded that there is no known machinery defect that would cause the erratic vibration signature. In addition, other pump parameters (the inboard bearing horizontal vibration value, discharge pressure, flow) remained steady and consistent with past pump performance. Furthermore, such significant changes in the pump outboard bearing vertical vibration instrument readings would also be observed to some degree in the pump inboard bearing horizontal vibration instrument readings if the pump were degrading.
>
> Due to the location of the malfunctioning vibration sensor (inside the containment building biological shield wall), a unit power reduction from 100% to approximately 20% would be required to enter containment and correct the problem. The power reduction is necessary to reduce the radiation field that makes the equipment inaccessible at full power.
>
> Monitoring of the pump vibration with only one probe functioning will ensure the health of the pump is sufficiently examined. For this component, degradation of the pump would be characterized by specific frequencies of vibration corresponding to the shaft speed and plunger cycling. In addition to reviewing acceptability of the overall vibration level at the horizontal sensor, Engineering will evaluate the frequency spectrum for each test. Review of pump failure modes with the manufacturer has determined that increases in vibration amplitude at shaft speed and plunger cycling frequency will give early indication of a degrading condition. Furthermore, the manufacturer has concluded that

there is no credible failure mechanism for the pump that would manifest itself in such a way that this level of monitoring would not detect failure.

Compliance with IWP vibration measurement requirements would be a hardship without a compensating increase in the level of quality and safety pursuant to 10 CFR 50.55a(a)3(ii), with the hardship being the unit power reduction that would be required in order to correct the malfunctioning vibration sensor.

2.2 Licensee's Proposed Alternative Testing (as stated)

The SSF RC Makeup Pump will be tested in accordance with IWP requirements except for the stated location of the vibration measurement point. Rather, vibration will be monitored on the pump inboard bearing in the horizontal direction that is perpendicular to the crankshaft and parallel to the line of plunger travel. This alternative will only be utilized until the next power reduction that would accommodate repair to the pump outboard bearing probe in the vertical direction.

3.0 EVALUATION

The ASME Code, Section XI (1986 Edition) requires an inservice test be run on the SSF RC makeup pump every 3 months during normal plant operation. Specifically, paragraph IWP-4510 requires that at least one displacement vibration amplitude (peak-to-peak) be read during each test. Paragraph IWP-4510 further specifies for reciprocating pumps that the location of the probe shall be on the bearing housing of the main pump drive shaft, approximately perpendicular to both the shaft and the line of plunger travel.

To measure the pump vibration during the Code tests, the licensee has permanently mounted two vibration sensors on the SSF RC makeup pump bearing housings. The pump outboard bearing probe is in the vertical direction (perpendicular to the crankshaft and perpendicular to the line of plunger travel) and the pump inboard probe is in the horizontal direction (perpendicular to the crankshaft and parallel to the line of plunger travel). Since the SSF RC makeup pump is located inside containment and is inaccessible during plant operations, the leads attached to the vibration sensors are routed through a containment penetration.

The pump outboard bearing vertical vibration probe is used by the licensee to meet the requirements in paragraph IWP-4510 for reciprocating pumps. During an extended pump run on March 8, 2002, the pump outboard bearing vertical vibration was found to be erratic. After a detailed engineering analysis of the vibration data and consultation with the pump manufacturer (APV Gaulin), the licensee concluded that there is no known machinery defect that would cause the erratic vibration signature. In addition, other pump parameters (the inboard bearing horizontal vibration value, discharge pressure, flow) remained steady and consistent with past pump performance. Vibration signals recorded during the same test period showed erratic readings by the vertical sensor while the horizontal sensor supplied a steady vibration signal. Such significant changes in the pump vertical vibration instrument readings would likely be observed to some degree in the pump inboard bearing horizontal vibration instrument readings if the pump were degrading.

As an alternative to the ASME Code requirement, the licensee proposed to test the SSF RC makeup pump in accordance with IWP requirements except for the stated location of the vibration measurement point. Vibration will be monitored on the pump inboard bearing in the horizontal direction that is perpendicular to the crankshaft and parallel to the line of plunger travel. In addition to reviewing acceptability of the overall vibration level at the horizontal sensor, the licensee's engineering staff will also evaluate the frequency spectrum for each test. In the licensee's review of the pump failure modes with the manufacturer, it was determined that increases in vibration amplitude at shaft speed and plunger cycling frequency will give early indication of a degrading condition. Furthermore, the manufacturer has concluded that there is no credible failure mechanism for the pump that would manifest itself in such a way that this level of monitoring would not detect failure. This alternative will only be utilized until the next power reduction that would accommodate repair to the pump outboard bearing probe in the vertical direction.

Compliance with ASME Code vibration measurement requirements would result in a hardship due to the location of the malfunctioning vibration sensor (inside the containment building biological shield wall). A unit power reduction from 100 percent to approximately 20 percent would be required to enter containment and correct the problem. The power reduction is necessary to reduce the radiation field that makes the equipment inaccessible at full power.

Based on the above information, the staff finds that compliance with the Code test for vibration with the probe approximately perpendicular to both the shaft and the line of plunger travel would necessitate reducing unit power to permit replacing the defective sensor and would, thus, cause hardship without compensating increase in level of quality and safety. The licensee's proposed alternative will provide reasonable assurance of operational readiness of the pump until the next power reduction in which the repair or replacement of the sensor can be completed.

4.0 CONCLUSION

Based on the review of information provided by the licensee, the staff concludes that compliance with Code-required test for the SSF RC makeup pump would result in hardship without a compensating increase in the level of quality and safety. On this basis, the licensee's proposed alternative is authorized pursuant to 10 CFR 50.55a(a)(3)(ii) until the next power reduction in which a repair or replacement of the sensor can be completed.

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Date: May 6, 2002

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