January 8, 2001

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

SUBJECT: OCONEE NUCLEAR STATION, UNIT 1 RE: USE OF ALTERNATIVE EXAMINATIONS FOLLOWING WELD REPAIR OF REACTOR VESSEL HEAD-TO-CONTROL ROD DRIVE MECHANISM, REQUEST FOR RELIEF NO. 00-05 (TAC NO. MB0847)

Dear Mr. McCollum:

By letter dated January 2, 2001, and supplemented by letter dated January 4, 2001, Duke Energy Corporation requested relief for Oconee Nuclear Station, Unit 1, from certain American Society of Mechanical Engineers Boiler and Pressure Vessel Code inservice inspection requirements associated with the repair of the No. 21 Control Rod Drive Mechanism (CRDM) nozzle-to-reactor vessel head weld.

Based on the enclosed safety evaluation, the staff has concluded that compliance with the Code requirements to perform liquid penetrant testing and radiographic examinations of the weld volume of the weld repair to the No. 21 CRDM nozzle-to-reactor vessel head weld would result in hardship or unusual difficulty for the licensee without a compensating increase in the level of quality and safety. Therefore, the staff authorizes use of ultrasonic examinations as an alternative to the Code-required radiographic examination for the subject CRDM nozzle-to-reactor vessel head weld repair pursuant to 10 CFR 50.55a(a)(3)(ii).

The staff is concerned with the lack of timeliness and thoroughness shown in the preparation of the submittal for this relief request that resulted in the need for conference calls, additional information, and rescheduling of staff resources to resolve the issues.

Sincerely,

/RA by Gary S. Janosko Acting for/

Richard L. Emch, Jr., Chief
Project Directorate II-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-269

Enclosure: As stated

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

THIRD TEN-YEAR INTERVAL INSERVICE INSPECTION PROGRAM PLAN

REQUEST FOR RELIEF NO. 00-05

DUKE ENERGY CORPORATION

OCONEE NUCLEAR STATION, UNIT 1

DOCKET NO. 50-269

1.0 INTRODUCTION

The inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, Class 2, and Class 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g), except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). 10 CFR 50.55a(a)(3) states in part that alternatives to the requirements of paragraph (g) may be used, when authorized by the NRC, if the licensee demonstrates that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) will meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. The ISI Code of record for Oconee Nuclear Station, Unit 1, third 10-year interval is the 1989 Edition of the ASME Code. The components (including supports) may meet the requirements set forth in subsequent editions and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) subject to the limitations and modifications listed therein and subject to Commission approval.

By letter dated January 2, 2001, as supplemented by letter dated January 4, 2001, Duke Energy Corporation (the licensee) submitted Relief Request No. 00-05, requesting relief from certain Code-required radiographic testing (RT) criteria for the third 10-year inservice inspection interval at the Oconee Nuclear Station, Unit 1 for repair of the No. 21 control rod drive mechanism (CRDM) nozzle-to-reactor vessel (RV) head weld.

2.0 RELIEF REQUEST 00-05, REPAIR OF THE NO. 21 CRDM NOZZLE-TO-REACTOR VESSEL HEAD WELD

2.1 Code Requirement for which Relief is Requested

The licensee decided to use a more current edition of the Code referenced in the 10 CFR 50.55a(b) for this repair. The Code for this repair is the 1992 Edition with no addenda.

Paragraph IWA-4533 of the ASME Code requires that the weld repair as well as the preheated band shall be examined by the liquid penetrant testing (PT) method after the completed weld has been at ambient temperature for at least 48 hours. The repaired region shall be examined by the RT method and, if practical, by the ultrasonic testing (UT) method following repair of dissimilar materials using the temper bead process in accordance with IWA-4530. IWA-4500(e)(2) defines the band around the weld repair area as 1-1/2 times the component thickness or 5 inches, whichever is less.

2.2 Licensee's Proposed Alternative to Code

In lieu of the requirements of IWA-4533, the licensee proposed the following:

1. Within the band around the weld repair, as defined by IWA-4500(e)(2), an interference exists that would prevent using PT over 100 percent of the band area associated with the No. 21 CRDM nozzle-to-RV head weld repair. The licensee proposed that the band area exclusive of the interferences be examined by PT.

2. Due to the thickness of the reactor vessel head and the complex geometry of the Oconee, Unit 1 RV head in the area of the CRDM nozzle, the licensee proposed that examination by UT be substituted for RT.

3.0 EVALUATION

The licensee identified leakage at the No. 21 CRDM nozzle-to-RV head weld. The leakage was from a crack on the inside surface of the RV head starting at the base of the weld and ending in the CRDM nozzle. Removal of the crack resulted in a partial penetration repair approximately 4-inches long by 3-inches wide by 2-inches deep on the inside surface of the RV head. The licensee used 152 Inconel weld material for the repair which made a dissimilar metal weld with the carbon steel RV head material and provided the surface cladding protection for the inside surface of the RV head. The repair joined the remaining original 182 Inconel weld material and replaced the removed Alloy 600 CRDM nozzle material. The licensee determined that the resulting weld repair could not be nondestructively examined according to Section III Code-requirements. The Code requires that the weld be examined using surface and RT techniques.

The repaired configuration is not amenable to RT. RT is used to identify flaws by detecting changes in material density. These changes can be due to differences in thickness or physical density as compared to the surrounding material. RT is not appropriate for this repair configuration because the weld connecting the CRDM nozzle-to-RV head is not a full penetration weld. The gap between the CRDM nozzle and RV head would mask flaws in that location, and the weld depth contour would vary, creating density changes. Also, the repair weld to the CRDM nozzle is not accessible from two directions for film and source placement.

In order to use RT, the CRDM nozzle-to-RV head would have to be redesigned which would result in extensive through-wall repair that would subject the vessel to internal stresses and subject personnel to large radiation doses. Moreover, the results of an RT would be questionable because of density changes between the base and weld metal and residual radiation from the base metal would render the film image inconclusive. Therefore, compliance with the Code RT requirement would create unusual difficulties and hardship for the licensee.

Instead of performing the RT examination, the licensee proposed to examine the weld using UT and to the extent practical PT, and to perform an additional examination of the inside surface of the CRDM nozzle bore using eddy current testing. UT is used to identify features that reflect sound waves. The degree of reflection depends largely on the physical state of matter on the opposite side of the reflective surface and to a lesser extent on specific physical properties of the matter (density). For instance, sound waves are almost completely reflected at metal-gas interfaces and partially reflected at metal-to-solid interfaces. Discontinuities that act as metal-gas interfaces, like cracks, laminations, shrinkage cavities, and bonding faults are easily detected. Inclusions and other metal inhomogeneities can also be detected by partial reflection of the sound wave.

Because the selected weld material and deposited weld thickness is similar to weld overlays used to reinforce degraded piping, the licensee chose to use a UT technique that is predominately a subset of the weld overlay technique demonstrated under the Electric Power Research Institute - Performance Demonstration Initiative program. The licensee designed the procedure to detect flaws in the weld overlay as well as under the weld overlay. To demonstrate the effectiveness of the procedure, the licensee used a cladded calibration block with side-drilled holes representing reflectors.

The proposed UT examinations will be performed using 0 degree and 60 degree longitudinal wave transducers and an outside diameter creeping wave transducer. The 60 degree longitudinal wave transducer will scan the repaired area in four orthogonal directions except where there is an interference. The licensee will evaluate indications according to NB-5330, “Ultrasonic Acceptance Standards.” Any indication with a crack-like signature will be evaluated and sized using tip diffraction techniques.

Based on the above evaluation, the staff concludes that compliance with the Code requirements for performance of PT and RT of the weld volume for the weld volume of the No. 21 CRDM nozzle-to-RV head weld would result in hardship or unusual difficulty for the licensee without a compensating increase in the level of quality and safety. The proposal to use UT and eddy current testing will provide a reasonable alternative to RT for identifying detrimental flaws for this configuration.

4.0 CONCLUSION

The staff concludes that compliance with the Code requirements to perform PT and RT of the weld volume would result in hardship or unusual difficulty for the licensee without a compensating increase in the level of quality and safety. Therefore, pursuant 10 CFR 50.55a(a)(3)(ii), the staff authorizes the proposed alternative for Oconee Nuclear Station,

Unit 1, No. 21 CRDM nozzle-to-RV head weld. The relief granted is authorized by law and will not endanger the common defense and security and is otherwise in the public interest giving due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility.

Principal Contributor: Donald Naujock

Date: January 8, 2001

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