Duke Power
A Duke Energy Company

W. R. McCollum, Jr.
Vice President

Duke Power
Oconee Nuclear Site
7800 Rochester Highway
Seneca, SC 29672
(864) 885-3107 OFFICE
(864) 885-3564 FAX

March 6, 2001

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

SUBJECT: Oconee Nuclear Station - Unit 3
Docket No. 50-287
Request for Authorization to Use Alloy 690 Welding Filler Material Per Code Cases 2142-1 and 2143-1 in accordance with 10 CFR 50.55a(a)(3)(i)

Pursuant to 10 CFR 50.55a(a)(3)(i), Duke Energy Corporation (DEC) requests the NRC to authorize the use of Alloy 690 welding filler material along with the associated ASME Boiler and Pressure Vessel Code, Section IX, Code Cases 2142-1 and 2143-1. These code cases would be applied as an alternative to the ASME Boiler and Pressure Vessel Code, Section XI, 1992 Edition with no addenda for Oconee Unit 3.

This request is to allow the application of Alloy 690 type weld filler material (Inconel 52/152) for the repair of nozzles and welds for Control Rod Drive Mechanisms (CRDM) on the Oconee Unit 3 Reactor Vessel head. Industry studies show that Alloy 690 weld filler materials possess a high resistance to primary water corrosion. DEC has evaluated and determined that the alternative material will provide an acceptable level of quality and safety, when compared to the materials allowed by the referenced code because of its superior corrosion resistant properties.

The NRC has previously approved the use of Inconel 52/152 for DEC applications. Specifically, DEC received approval on; 1) September 10, 1999 to apply Alloy 690 (and the associated Code Cases) to the Oconee replacement steam generators (TAC Nos. MA6209, MA6210, and MA6211), and 2) January 8, 2001 to apply Alloy 690 (and the associated Code Cases) for Unit 1 reactor vessel head weld repairs (TAC No. MB0854).

A047

A detailed description of this proposed alternative, including a background discussion and justification is included as an attachment to this letter. Use of this alternative weld material is scheduled to start on March 9, 2001. Entry into Mode 3 is presently scheduled for March 30, 2001.

Questions regarding this request may be directed to Robert Douglas at (864) 885-3073.

Very truly yours,

William R. McCollum

Attachment:

Request for Alternative, Serial Number 01-02

xc w/att:

L. A. Reyes, Regional Administrator
U.S. Nuclear Regulatory Commission, Region II
Atlanta Federal Center
61 Forsyth St., SW, Suite 23T85
Atlanta, GA 30303

D. E. Labarge, Senior Project Manager (ONS)
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop O-8 H12
Washington, D.C. 20555-0001

xc(w/o attch):

M. E. Shannon,
NRC Senior Resident Inspector
Oconee Nuclear Station

Mr. Virgil Autrey
Division of Radioactive Waste Management
Bureau of Land and Waste Management
SC Dept. of Health & Environmental Control
2600 Bull St.
Columbia, SC 29201

DUKE ENERGY CORPORATION
Oconee Nuclear Station, Unit 3

Request for Alternative Material than approved by the ASME Boiler and Pressure Vessel Code, Section XI

Applicable Code Edition and Addenda

ASME Boiler and Pressure Vessel Code, Section XI, 1992 Edition with no addenda.

Description of Code Requirement(s) for Which an Alternative is Requested

The Code to be utilized for the repairs to the CRDM nozzles and associated welds described in this request is the 1992 ASME Code Section XI with no addenda. The 1992 code allows, by reference, the use of Alloy 600 based weld filler material (Inconel 82/182) but does not include the use of Alloy 690 based weld filler material (Inconel 52/152).

Code cases 2142-1 and 2143-1 introduce and classify new nickel based weld metals that closely match Alloy 690. Code Case 2142-1 establishes welding classifications and other requirements for bare wire filler metal (UNS N06052 Ni-Cr-Fe). Code Case 2143-1 establishes welding classifications and other requirements for a coated electrode (UNS W86152 Ni-Cr-Fe). These two Code cases have not been incorporated by reference into the regulations; therefore, their use requires NRC approval.

Description of Proposed Alternative

In lieu of the requirements of the 1992 code, the use of Alloy 690 weld filler material is proposed for the repair of CRDM nozzles and associated welds located on the Oconee Unit 3 Reactor Vessel (RV) head. At present, use of this filler material is needed for CRDM Nos. 11, 23, 28, 34, 50, 56 and 63. Additional inspections may identify other CRDMs requiring repair of the RV head nozzles and/or their

associated weld for which this alternate is also proposed. These CRDMs include Nos. 1, through 10, 12 through 22, 24 through 27, 29 through 33, 35 through 49, 51 through 55, and 57 through 69.

In addition, DEC requests the use of ASME Code Cases 2142-1 and 2143-1 that group the new weld filler material in the same welding category as other commonly employed nickel based weld filler metals. This allows the use of appropriate existing welding procedures and performance qualifications with the new weld metals.

Justification for Using the Proposed Alternative

Industry studies have demonstrated that Alloy 690 weld materials possess a high resistance to primary water corrosion. The use of Alloy 690 has been previously approved for other applications at Oconee.

The material properties of the existing Alloy 600 (82/182) weld material were compared to the new proposed Alloy 690 (52/152) weld material. The thermal expansion coefficient of the 52/152 weld material is somewhat higher than the coefficient of the 82/182 weld material (at 600F, the difference is about 4%), however the modulus of elasticity is lower for the 52/152 weld material than the 82/182 weld material. Since the thermal stress is a function of the product of the modulus of elasticity and the thermal expansion coefficient ($\sigma = E\alpha\Delta T$), the effects tend to cancel each other. For example, at 600F the difference in the products is only 2%. Thus, the presence of the two weld materials will have an insignificant effect on the thermal stresses in the total weld.

An evaluation of possible weld dilution concluded that the percentage of chromium in the deposited welds, in all repair scenarios will exceed 22%. Materials with chromium concentrations above 22% have demonstrated resistance to Primary Water Stress Corrosion Cracking (PWSCC). In summary, the chromium content of the repaired surfaces containing the proposed Alloy 690 material, considering chromium dilution, will exceed that of the original Alloy 600 material, and thus afford superior corrosion resistance.

Background Information

Repairs to the subject CRDM nozzles and welds are required because of the discovery of small amounts of boron at those locations during a normal visual inspection of the RV head following a shutdown of the reactor to repair a Pressurizer code safety valve. This pressure boundary degradation was reported to the NRC on February 19, 2001 in accordance with 10CFR50.72(b)(3)(ii).

Non-destructive examinations utilizing eddy current and ultrasonic methods have been completed for the nozzle base metal of CRDM nozzles Nos. 11, 23, 28, 34, 50, and 56. Liquid penetrant inspections have also been completed for each J groove partial penetration weld connecting these CRDM nozzles to the inside radius of the RV head. These inspections determined indications in each of the nozzles identified above. The indications can be grouped into three categories: (1) indications in the J groove partial penetration weld, (2) indications in the nozzle base metal above the J grove partial penetration weld, and (3) indications in the nozzle base metal below the J groove partial penetration weld. Nozzles 11, 23, and 50 contain all three types of indications. Indications in nozzles 28, 34, and 56 were in the weld and in the nozzle base metal below the weld. The results of these inspections were used as input in determining the repair design.

The repair design methods have been developed for each nozzle, based on the discovered indications. It is expected that repairs will require excavation of the weld and portions of the outside diameter of the nozzles to clear all indications and replacement of the excavated material with 52/152 material. In addition, it is anticipated that the lower portions of nozzles 11, 23, 28, 50, and 56 below the weld will be cut and removed. All cut surfaces and all replacement material will then receive an overlay consisting of the 52/152 material.

The above description of repairs to CRDM Nos. 11, 23, 28, 34, 50, and 56 is anticipated to bound the repairs needed for similar types of repairable indications that may be identified by the non-destructive examination of other CRDMs, including No. 63.

The Quality and Safety Provided by the Proposed Alternative

Alloy 690 material has been shown to be superior to Alloy 600 material in resisting Primary Water Stress Corrosion Cracking (PWSCC). In a letter to the NRC dated August 6, 1999, DEC requested authorization to use the Alloy 690 material in the construction of the replacement steam generators to be installed at Oconee starting in 2003. The NRC approved the request by letter dated September 10, 1999. Similarly, the NRC has authorized the use of Alloy 690 material in the construction of replacement steam generators for McGuire Nuclear Station Units 1 & 2, and Catawba Nuclear Station Unit 1. The NRC has also approved a similar request by letter dated January 8, 2001, for use of Alloy 690 material in the repairs to several of the Oconee Unit 1 thermocouple nozzles, and the Unit 1 CRDM No. 21 nozzle.

ASME Code Cases 2142-1 and 2143-1 establishes the uniform chemical and material properties and the classification of the weld material with respect to its welding characteristics. Code Case 2142-1 establishes the F-No. for the American Welding Society (AWS) specification AWS A5.14 and Unified Numbering System (UNS) designation UNSN06052 (Inconel 52) as F-No. 43 for both procedure and performance qualification purposes. Code Case 2143-1 establishes the F-No. for AWS A5.11 and UNS designation W86152 (Inconel 152) for a coated electrode as F-No. 43 for welding purposes. These sets of specifications and F-No. assignments completely describe this material for welding purposes as similar in their welding characteristics to other Code approved nickel based weld metals.

In conclusion, the use of Alloy 690 welding filler material (Inconel 52/152) and the associated AMSE Code Cases 2142-1 and 2143-1 for the repairs to Oconee Unit 3 CRDMs nozzles will provide superior corrosion protection over that provided by Alloy 600 (Inconel 82/182) material. A detailed analysis of the specific application has produced acceptable results. The use of Alloy 690 has been previously authorized for new construction and other repair

activities. Therefore, the proposed alternative provides an acceptable level of quality and safety.

Duration of the Proposed Alternative

The proposed alternative applies only to the repairs to Oconee Unit 3 Reactor Vessel head CRDMs.

Originated By: Timothy D. Brown 3-5-01
Timothy D. Brown Date

Reviewed By: L. J. Azzarello 3/5/01
Leonard J. Azzarello Date