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

Subject: Duke Energy Corporation
Catawba Nuclear Station Unit 2
Docket Number 50-414
Request for Alternative, Serial Number 01-02
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 XI, Code Case 2142-1 and 2143-1. These code cases would be applied as an alternative to the ASME Boiler and Pressure Vessel Code, Section XI, 1989 Edition with no addenda for Catawba Unit 2.

This request is to allow the application of Alloy 690 type weld filler material (Inconel 52/152) for repair of nozzles and welds for channel head bowl drain(s) on Westinghouse D5 steam generators at Catawba Unit 2. 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 reference 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) to apply Alloy 690 (and associated code cases) for Oconee reactor vessel head weld repairs (Unit 1, TAC No. MB0854, January 8, 2001; Unit 2, TAC No. MB1835, May 21, 2001; Unit 3, TAC No. MB1319, April 13, 2001). Similarly, the NRC has authorized the use of Alloy 690 material in the construction of replacement steam generators for McGuire Nuclear Station Units 1 and 2 and Catawba Nuclear Station Unit 1.

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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 October 5, 2001. Entry into Mode 3 is presently scheduled for October 15, 2001. Therefore, Duke specifically requests NRC approval of this proposed alternative by October 15, 2001.

Since this alternative provides relief from the ASME Code, there are no regulatory commitments in this letter or its attachment.

Inquiries on this matter should be directed to R. D. Hart at (803) 831-3622.

Very truly yours,

Gary R. Peterson

RDH/s

Attachment:

Request for Alternative, Serial Number 01-02

xc (with attachments):

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DUKE ENERGY CORPORATION
Catawba Nuclear Station, Unit 2

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, 1989 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 channel head bowl drain(s) on Westinghouse D5 steam generators and associated welds described in this request is the 1989 ASME Code Section XI with no addenda. The 1989 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 1989 code, the use of Alloy 690 weld filler material is proposed for the repair of channel head bowl drain on Westinghouse D5 steam generators (Catawba Nuclear Station Unit 2 only). At present, the use of this filler is needed for steam generator 2B channel head bowl drain only. Additional inspections may identify other steam generators requiring repair of the channel head bowl drain nozzles and their associated weld(s) for which this alternative is also proposed.

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, McGuire, and Catawba.

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 600 °F, the difference is about 4%), however, the modulus of elasticity is lower for 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 600 °F 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

Repair to the subject steam generator bowl drain nozzle and weld(s) is required because of the discovery of small amounts of boron residue at the drain pipe location during preparation activities in support of eddy current examination of steam generator tubing. The pressure boundary degradation was reported to the NRC on September 19, 2001 in accordance with 10CFR50.72(b)(3)(ii)(A).

Non-destructive examinations utilizing liquid penetrant testing (PT) have been performed for each of the (4) steam generator bowl drain welds. These partial penetrations with fillet cap welds are between the vessel wall and a stainless steel coupling. No indications were identified on 2A, 2C and 2D steam generators. On the steam generator 2B bowl drain coupling / nozzle connection, two indications were found at the toe of the weld on the vessel side. One rounded indication found at 12 o'clock was approximately 5/16" to 3/8" in diameter. The second indication found at 7 o'clock was approximately 3/16" in diameter. Liquid penetrant testing was performed twice to assure indications were

relevant. Eddy current testing of the Alloy 600 tubing penetrating the steam generator channel head bowl will also be performed.

The repair design for the steam generator 2B bowl drain nozzle has been developed based on the discovered indications. The existing coupling will be removed, ensuring that the failed weld fracture surfaces are preserved. Grinding to remove the localized weld filler metal and chase the indication will be performed in approximately 1/16" incremental depths. Liquid penetrant testing will be performed at each incremental stage and videotaped to record the mapping of the flaw. After the complete removal and mapping of the flaw(s), the remaining portion of Alloy 600 (82/182) weld material will be removed to the extent practicable. Buttering of the excavated cavity with Alloy 690 (52/152) material will be performed followed by machining to allow the partial insertion of a replacement stainless steel coupling. This repair process will ensure that primary side water is effectively isolated from any remaining Alloy 600 (82/182) weld material. Final welding with 52/152 filler material will restore the nozzle connection to its original configuration.

The above description of repair to the steam generator 2B channel head drain nozzle is anticipated to bound similar repairable indications of the other Unit 2 steam generators should they be identified by future inspections / examinations.

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 replacement steam generators to be installed at Oconee in future outages. 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. 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) to apply Alloy 690 (and associated code cases) for Oconee reactor vessel head weld repairs (Unit 1, TAC No. MB0854, January 8, 2001; Unit 2, TAC No. MB1835, May 21, 2001; Unit 3, TAC No. MB1319, April 13, 2001).

ASME Code cases 2142-1 and 2143-1 establish 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 materials.

In conclusion, the use of Alloy 690 welding filler material (Inconel 52/152) and the associated ASME Code cases 2142-1 and 2143-1 for the repairs to Catawba Unit 2 steam generator channel head bowl drain nozzles and/or their associated weld(s) 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 Catawba Unit 2 steam generator channel head bowl drain nozzles.

Simplified Diagram of Steam Generator Channel Head Bowl Drain