



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

ALTERNATIVE TO WELD MATERIALS IN
REPLACEMENT STEAM GENERATORS AT THE
OCONEE NUCLEAR STATION, UNITS 1, 2 AND 3
DUKE ENERGY CORPORATION

DOCKET NOS. 50-269, 50-270, AND 50-287

1.0 INTRODUCTION

By letter dated August 6, 1999, Duke Energy Corporation (the licensee) requested relief from certain weld material requirements used in the fabrication of the replacement steam generators for the Oconee Nuclear Station (ONS), Units 1, 2, and 3. The licensee proposed implementing the criteria from the American Society of Mechanical Engineers (ASME) Code Cases (CC) 2142-1, "F- Number Grouping for Ni-Cr-Fe, Classification UNS N06052 Filler Metal, Section XI," and CC 2143-1, "F-Number Grouping for Ni-Cr-Fe, Classification UNS W86152 Welding Electrode, Section XI," as an alternative to the requirements in the ASME Boiling and Pressure Vessel Code (Code). CC 2142-1 and CC 2143-1 provide criteria for weld material F number classifications.

2.0 BACKGROUND

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(4), ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except design and access provisions and preservice examination requirements, set forth in Section XI of editions of the Code and addenda that become effective subsequent to the editions specified in paragraphs (g)(2) and (g)(3) of this section and that are incorporated by reference in paragraph (b) of this section, to the extent practical within the limitations of design, geometry, and materials of construction of the components.

New steam generators (SGs) are being designed and manufactured for ONS, and their installation is planned for 2003 and 2004.

2.1 Code Requirements

The licensee is building the replacement SGs to the 1989 Edition of Section XI of the Code. Subsubarticle IWA-4120(a) to Section XI of the Code states that "repairs shall be performed in accordance with the Owner's Design Specification and the original Construction Code of the component or system. Later editions and addenda of the Construction Code or of Section III, either in their entirety or portions thereof, and code cases may be used." Subparagraph NB-2539.2 of Section III of the Code states that "the welding procedure and welders or welding

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operators shall be qualified in accordance with NB-4000 and Section IX." Subparagraph QW-200.1(c) of Section IX of the Code states that changes in essential or supplementary essential variables require requalification of the welding procedure specification. Essential variables for the different welding techniques are outlined in Paragraphs QW-250 through QW-280. These paragraphs identify the F-number as an essential variable. In Paragraph QW-432, weld materials with similar chemistries are grouped together and assigned an F-number.

2.2 Request for Relief

Pursuant to 10 CFR 50.55a(a)(3) proposed alternatives to the requirements of paragraphs (c), (d), (e), (f), (g), and (h) of 50.55a or portions thereof may be used when authorized by the NRC. The applicant shall demonstrate that: (i) the proposed alternatives would provide an acceptable level of quality and safety, or (ii) compliance with the specified requirements of 50.55a would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.3 Basis for Relief

In a letter dated August 6, 1999, the licensee requested authorization to use CC 2142-1 and CC 2143-1. These code cases are needed to classify weld material not listed in QW-432. The weld materials have chemistries similar to the chemistries of the material to be welded in the steam generators. The weld materials have been shown in an Electric Power Research Institute (EPRI) study to provide superior corrosion resistant weldments for applications with Alloy 690 material.

These CCs were approved by ASME on June 5, 1995, and reaffirmed on July 22, 1998. The CCs classified the weld material as F-No. 43 for both weld procedures specifications and procedure qualification reports. The weld material has been designated as UNS W86152 for the shielded metal arc welding electrode for Alloy 690 and UNS N06052 for the companion bare wire electrode.

Based on CCs 2142 and 2143 these filler weld materials were approved by the NRC for use in the fabrication of replacement steam generators in a letter dated July 20, 1993, for McGuire Nuclear Station, Units 1 and 2 and Catawba Nuclear Station, Unit 1.

3.0 EVALUATION

3.1 Proposed Alternative Examination

The licensee proposed the alternative to use filler weld material defined by CC 2142-1 and 2143-1 for welding Alloy 690 material in lieu of Code-required filler weld material identified in QW-432. The proposal is for the replacement steam generators.

3.2 Discussion

The licensee is using Alloy 690 in its fabrication of the Oconee replacement SGs. Alloy 690 was chosen for this application because of its improved resistance to intergranular stress corrosion cracking (IGSCC) and general corrosion in a simulated reactor environment.

The existing SGs were fabricated with Alloy 600. In a study by the EPRI Report NP-5882M, "Stress Corrosion Cracking Resistance of Alloys 600 and 690 and Compatible Weld Metals in BWRs," these alloys were evaluated for corrosion susceptibility. The results showed that the Alloy 690 weld metals were more resistant to IGSCC as well as general corrosion in pure water environments than Alloy 600. Another study, "Corrosion Testing of Inconel Alloy for PWR Steam Generators," by J.R. Crum and R.C. Scarberry, Journal of Materials for Energy Systems, Vol. 4., No. 3, December 1982, drew conclusions similar to the EPRI report. Not considered in either study was the effect of heat-to-heat variations in the weld metal compositions. Such variations were found to play a substantial role in the IGSCC susceptibility of Alloy 600. The strong performance of Alloy 690 suggests that the effects from heat-to-heat variations would be minimal.

Weld filler materials that are similar to Alloy 690 were approved by the Code on June 5, 1995, in CCs 2142-1 and 2143-1. These code cases were reaffirmed July 22, 1998. The code cases established the F-No. 43 for the specified weld filler material. By allowing the licensee to use CC 2142-1 and CC 2143-1, the staff is affirming the Code designation of F-No. 43. Affirming this Code designation for CC 2142-1 and CC 2143-1 permits the specified filler weld material to be used in previously qualified weld procedures, thus eliminating the need for creating new procedures and performance qualifications. Since the specified filler weld materials are similar in their welding characteristics to many other Code nickel base filler weld materials, the staff has concluded that separate procedure and performance qualifications for these materials are not warranted. The use of previously qualified procedure and performance standards for welding with the filler weld metals described in CC 2142-1 and CC 2143-1 will provide an acceptable level of quality and safety.

The staff has authorized the use of F-No. 43 for the chemistries described in CC 2142-1 and 2143-1 in letters dated July 20, 1993, for McGuire Nuclear Station, Units 1 and 2 and Catawba Nuclear Station, Unit 1 and letter dated December 15, 1998, for South Texas Project, Units 1 and 2.

4.0 CONCLUSION

Based on the above evaluation, the staff concludes that the proposed alternative to use CC 2142-1 and CC 2143-1 will provide an acceptable level of quality and safety. Pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative for the ONS replacement SGs.

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