



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST TO USE ALTERNATIVE MATERIALS IN THE FABRICATION

OF STEAM GENERATORS AT THE

OCONEE NUCLEAR STATION, UNITS 1, 2, AND 3

DUKE ENERGY CORPORATION

DOCKET NUMBERS 50-269, 50-270, AND 50-287

1.0 INTRODUCTION

By letter dated September 23, 1999, Duke Energy Corporation (the licensee or Duke) requested approval under the provisions of 10 CFR 50.55a(a)(3) to use the American Society of Mechanical Engineers (ASME) Section III Code Case N-20-4 during the fabrication of replacement steam generators for the Oconee Nuclear Station, Units 1, 2, and 3 (Oconee). Code Case N-20-4 describes various requirements for three nickel-based alloys (alloys 600, 690, and 800) for use in the construction of Class 1 components in accordance with the ASME Code, Section III, Division 1. Duke intends to use alloy 690 tubing in its replacement steam generators.

The ASME approved Code Case N-20-4 on February 26, 1999, and published the code case in the 1998 Edition of the ASME Boiler and Pressure Vessel Code, Code Cases Supplement No. 4. Because the NRC has not incorporated N-20-4 by reference into the regulations, the licensee cannot use this Code Case without prior NRC review and approval.

Section 50.55a, "Codes and Standards," of 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires, in part, that components of the reactor coolant pressure boundary be designed, fabricated, erected, and tested in accordance with the requirements for Class 1 components of Section III, "Nuclear Power Plant Components," of the ASME Boiler and Pressure Vessel Code or equivalent quality standards. Footnote 6 to 10 CFR 50.55a states that the use of specific code cases may be authorized by the Commission upon request pursuant to 10 CFR 50.55a(a)(3), which requires that proposed alternatives to the described requirements or portions thereof provide an acceptable level of quality and safety.

2.0 DISCUSSION

Alloy 690 is the material of choice in place of alloy 600 for newly fabricated steam generators. This choice is the result of numerous laboratory studies that show alloy 690 has little or no susceptibility to intergranular stress corrosion cracking in environments that simulate pressurized water reactor and boiling water reactor plant conditions. Licensees for domestic facilities have used alloy 690 in the fabrication of replacement steam generators since 1989.

Enclosure

Industry experience to date continues to support the use of this material as an enhancement over alloy 600. The NRC approved the use of alloy 690 tubing by incorporating the code case into Regulatory Guide (RG) 1.85, "Materials Code Case Acceptability ASME Section III, Division 1." The latest revision of RG 1.85, Revision 31, dated May 1999, approves the use of Code Case N-20-3.

Code Case N-20-4 differs from Code Case N-20-3 in a few minor ways. Code Case N-20-4 no longer includes a chemistry table for alloy 690, nor does it include a "specified mechanical properties and size ranges" table. The staff finds this acceptable because Code Case N-20-4 references material specification SB-163, "Specification for Seamless Nickel and Nickel Alloy Condenser and Heat-Exchanger Tubes," and the material specification contains this information. Code Case N-20-4 added a table containing tensile strength values at various temperatures. The staff finds this acceptable because this provides additional useful information relevant to steam generator design. Lastly, Code Case N-20-4 revised the design stress intensity values and yield strength values for alloy 690. These revisions resulted from increased industry experience with alloy 690 tubing. According to the licensee, industry experience at the time N-20-3 was issued was limited primarily to alloy 600. Because of the similarity of the materials, it was assumed that the mechanical properties would be similar. As industry experience with alloy 690 grew, it was determined that a consistent difference exists in the mechanical properties between alloy 600 and alloy 690. Alloy 690 has a yield strength approximately 10 percent lower than alloy 600 and a tensile strength less than 10 percent lower. The ASME subsequently issued N-20-4 to accurately reflect the alloy 690 mechanical properties. The staff finds the revised stress intensity values and yield strength values acceptable because they reflect more accurate material property information. In addition, the revised values are lower and thus more conservative than those provided in the previous Code Case.

In summary, the staff concludes that Code Case N-20-4 is acceptable. Code Case N-20-4 provides the same general requirements as Code Case N-20-3, which was approved by the staff in RG 1.85, Revision 31. Code Case N-20-4 provides updated mechanical property information about alloy 690 tubing that is conservative relative to the previously approved revision.

### 3.0 CONCLUSION

The staff concludes that Code Case N-20-4 provides an acceptable level of quality and safety. Pursuant to 10 CFR 50.55a(a)(3)(i), relief is authorized to employ Code Case N-20-4 for the replacement steam generator project at Oconee. Use of Code Case N-20-4 is authorized until the Code Case is approved by reference in RG 1.85. At that time, if the licensee intends to continue to implement this Code Case, the licensee is to follow all provisions in Code Case N-20-4 with limitations issued in RG 1.85, if any.

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Dated: December 22, 1999