October 27, 1994

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Mr. Robert E. Link, Vice President
Nuclear Power Department
Wisconsin Electric Power Company
231 West Michigan Street, Room P379
Milwaukee, WI 53201

SUBJECT: POINT BEACH NUCLEAR PLANT, UNIT 2 - RELIEF REQUEST FOR APPROVAL TO USE WELD METAL ALLOY 690 (TAC NO. M90437)

Dear Mr. Link:

By letter dated September 9, 1994, you requested relief to use alloy 690 weld metal in the fabrication and installation of the replacement steam generators for the Point Beach Nuclear Plant, Unit 2. You also requested use of American Society of Mechanical Engineers Code Cases 2142 and 2143.

The staff has reviewed and evaluated your request, and has determined that the proposed alternatives are acceptable. The staff finds that the use of alloy 690 weld metal and the use of ASME Code Cases 2142 and 2143 will provide an acceptable level of quality and safety, and authorizes their use pursuant to 10 CFR 50.55a(a)(3)(i). Since this is a first time use for the alloy 690 weld metals, the staff recommends that you either use one heat of each type of weld metal or keep detailed records of individual heat usage locations.

If you have any questions, please call Allen Hansen at (301) 504-1390.

Sincerely,

ORIGINAL SIGNED BY

Cynthia A. Carpenter, Acting Project Director
Project Directorate III-3
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Docket No. 50-301
Enclosure: Safety Evaluation
cc w/encl: see next page

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

October 27, 1994

Mr. Robert E. Link, Vice President
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Mr. Robert E. Link, Vice President
Wisconsin Electric Power Company

Point Beach Nuclear Plant
Unit Nos. 1 and 2

cc:

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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 AND

INSTALLATION OF STEAM GENERATORS AT

WISCONSIN ELECTRIC POWER COMPANY

POINT BEACH NUCLEAR PLANT, UNIT 2

DOCKET NO. 50-301

1.0 INTRODUCTION

By letter dated September 9, 1994, Wisconsin Electric Power Company (licensee) requested approval under the provisions of 10 CFR 50.55a(a)(3)(i) to use ASME Section IX Code Cases 2142 and 2143 during the impending fabrication and installation of replacement steam generators (SG's) for the Point Beach Nuclear Plant (PBNP), Unit 2. These two Code Cases introduce and classify new nickel base weld metals that closely match and are intended for welding Alloy 690. Code Case 2142 establishes welding classifications and other requirements for a bare wire filler metal. Code Case 2143 establishes welding classifications and other requirements for a coated electrode.

The subject Code Cases were adopted by the ASME on December 7, 1992, and were published in ASME Code Case Supplement 3 in April 1993. Due to the fact that this is a Supplement to the 1992 edition of the ASME Code, these Code Cases cannot be used by the licensees without prior NRC staff review. The 1992 edition of the ASME Code has not been incorporated, by reference, into NRC regulations.

The licensee intends to use Alloy 690 tubing and components in the fabrication and installation of replacement steam generators for the PBNP, Unit 2. The licensee believes that use of the new weld metals will enhance the service life of the replacement SG's. Industry studies indicate that these new weld metals are less susceptible to intergranular stress corrosion cracking (IGSCC) than the other nickel base weld metals currently applied.

Use of Code Cases 2142 and 2143 is advantageous to the licensee because it eliminates the burden of requiring qualification of separate welding procedures for each weld metal, as is the case for non-Code welding materials.

Thus, this relief request incorporates two issues:

1. Use of Alloy 690 type weld metals in Code Class 1 construction, and,

2. The use of two ASME Code Cases, which group the new weld metals in the same welding categories as other commonly employed nickel base weld metals. This allows the use of appropriate existing welding procedures and performance qualifications with the new weld metals.

2.0 EVALUATION

Due to the extensive history of IGSCC problems in alloy 600, the industry has sought an alternative alloy. Currently, alloy 690 is the industry material of choice. This choice is the result of numerous laboratory studies, which show that alloy 690 has little or no susceptibility to IGSCC in environments that simulate PWR and BWR plant conditions. The staff has reviewed these laboratory test results, and has determined that, based upon the available technical evidence, the use of alloy 690 base material in nuclear plant construction is acceptable.

Alloy 600 type weld metals (such as Inco 82 and 182) were widely used during the construction of nuclear power plants. Operating experience showed that Inco 182 was also susceptible to IGSCC, although primarily in BWR environments. Weld metals matching alloy 690 have also been tested in simulated PWR and BWR environments. Commercial development of these weld metals lagged behind that of the alloy 690 base metal.

Corrosion studies examining the susceptibility of weld metals to IGSCC in steam generator environments are scant compared to the voluminous base metal studies, because the base metal performance is a strong indicator of the expected performance of a matching weld metal. Results of the principle study, which included weld metals, are found in the Electric Power Research Institute (EPRI) report NP-5882M, titled "Stress Corrosion Cracking Resistance of Alloys 600 and 690 and Compatible Weld Metals in BWRs." Two experimental alloy 690 weld metals were tested under the same conditions as the base metals, thus allowing direct comparison of results. Results showed that both of the alloy 690 weld metals are immune to IGSCC in pure water environments. However, since these were laboratory simulations of a BWR environment, the results are only an indicator, and not a guarantee, of the weld metals performance in a PWR environment.

In the EPRI report, the designations R-127 and R-135 were used for the experimental weld metals. These were the Inco designations for the developmental weld metals that became Inco 52 and 152, respectively. Inco 52 is the commercial filler metal (tig wire) described in ASME Code Case 2142. Inco 152 is the coated electrode described in Code Case 2143.

Another paper, "Inconel 690: A New High Nickel Alloy for Corrosive Environments at Elevated Temperature," by A. J. Sedriks, et al., of the Inco Research and Development Center, included tests of a matching filler metal in a wide variety of environments. The two most interesting tests were conducted in simulated SG environments: deaerated ammoniated and borated water at 316 degrees C. Test results showed the welds and weld metal were highly resistant to general corrosion.

SCC susceptibility was tested by exposing welds to a variety of chloride environments. The controls used in these tests were alloy 800 (not 600) and type 304 stainless steel. Both of these alloys are known to crack in elevated temperature chloride environments. The alloy 690 in all cases was tested for periods significantly longer than the time to crack alloy 800 (the more resistant of the two control alloys). The alloy 690 welds did not crack, despite test durations 8 times longer than that of the control alloys.

Additional testing for IGSCC susceptibility in pure water environments was conducted. Another group of alloy 690 welds plus control alloys were exposed to undeaerated water at elevated temperatures in the presence of a crevice. Cracking was readily initiated within the controls. The alloy 690 welds did not crack, despite testing durations 24 times longer than for alloy 600 and 12 times for alloy 800 and 304 stainless.

The effect, if any, of heat-to-heat variations in the weld metal compositions were not considered in either study. Such variations were found to play a substantial role in the IGSCC susceptibility of alloy 600. The strong performance of alloy 690 suggests there would be minimal effect from the heat-to-heat variations.

Code Case 2142 lists the American Welding Society (AWS) specification (AWS A5.14) and UNS designation (UNS N06052) for a filler metal conforming to Inco 52. The weld metal is designated as F-No. 43 for both procedure and performance qualification purposes. Code Case 2143 lists appropriate AWS and UNS specifications for a coated electrode matching Inco 152 and establishes F-No. 43 for this material for welding purposes. By this set of specifications and F-No. assignments, these materials are completely described for welding purposes as similar in their welding characteristics to many other Code nickel base weld metals. Thus, these two weld metals are exempted from the requirements for specific procedure and performance qualifications for non-Code materials.

3.0 CONCLUSION

The staff concludes that based upon the available technical evidence, it is acceptable to use the subject weld metals as a substitute for other weld metals, where the licensee has determined that their use could enhance the safety of the replacement steam generators. Further, the staff finds that the Code Cases appropriately identify and classify these same two weld metals for welding purposes, thereby eliminating the burden that would be imposed by the requirement for special procedure and performance qualifications for non-Code materials. Based on the above discussion and, pursuant to

10 CFR 50.55a(a)(3)(i), the staff has determined that the licensee's proposed use of the Alloy 690 weld metal and employment of Code Cases 2142 and 2143 as an alternative would provide an acceptable level of quality and safety and is authorized as requested.

Due to the fact this would be a "first use" for these weld metals, the staff recommends that the licensee, either use one heat of each type of weld metal, or, maintain detailed records of individual heat usage locations for this project.

Principal Contributor: G. Hornseth
G. Dentel

Date: October 27, 1994