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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST TO USE ALTERNATIVE MATERIAL

IN THE REPAIR OF PRESSURIZER INSTRUMENT NOZZLES AT

FLORIDA POWER AND LIGHT COMPANY

ST. LUCIE UNIT NO. 2

DOCKET NO. 50-389

1.0 INTRODUCTION

By letter dated March 23, 1994, Florida Power and Light Company (the licensee) requested approval under the provisions of 10 CFR 50.55a(a)(3)(i) to use ASME Section IX Code Case 2142 during the repair of pressurizer instrument nozzles at St. Lucie Unit 2. This Code case introduces and classifies a new nickel-base filler metal that closely matches and is intended for welding Alloy 690. Code Case 2142 establishes welding classifications and other requirements for a bare wire filler metal.

The subject Code case was adopted by the ASME on December 7, 1992. Due to the fact that this is a Supplement to the 1992 edition of the ASME Code, this Code case 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 the regulations.

The licensee intends to use the subject filler metal during the ongoing repair of pressurizer instrument nozzles. The licensee believes that use of this filler metal will enhance the service life of the repaired nozzles. Industry studies indicate that this filler metal is less susceptible to intergranular stress corrosion cracking (IGSCC) than the other nickel-base weld metals currently applied.

Use of Code Case 2142 is further advantageous to the licensee because it eliminates the burden of requiring qualification of separate welding procedures for this filler metal, as is the case for non-Code welding materials.

Thus, this relief request incorporates two issues:

1. Use of Alloy 690 type filler metals in Code class 1 construction, and,

2. The use of this ASME Code Case which groups the filler metal in the same welding categories as other commonly employed nickel-base filler metals. This allows the use of appropriate existing welding procedures and performance qualifications with the new filler metal.

2.0 DISCUSSION

Due to the extensive history of IGSCC problems in Alloy 600, the industry 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 less susceptibility to IGSCC in environments that simulate PWR and BWR plant conditions. NRC staff review of these laboratory test results has resulted in the staff position that, based upon the available technical evidence, there is no technical reason to disallow the use of Alloy 690 base material in nuclear plant construction.

Alloy 600 type weld metals (such as Inco 182) were widely used during the construction of nuclear power plants. Operating experience showed that such weld metals were 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 that of the Alloy 690 base metal. No matching filler metal has been commercially available until recently.

Corrosion studies examining the susceptibility of weld metals to IGSCC in steam generator environments are scant compared to the voluminous base metal studies. This is 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. They were tested under the same conditions as the base metals, thus allowing direct comparison. Results showed that both of the Alloy 690 weld metals are highly resistant 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.

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 an Alloy 690 matching filler metal in a wide variety of environments. The two most applicable tests were conducted in simulated SG environments: deaerated ammoniated and borated water at 316°C. Test results showed the welds and weld metal were highly resistant to general corrosion.

IGSCC 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. In all cases, Alloy 690 was tested for periods significantly longer than the time to crack Alloy 800 (the more resistant of the two control alloys). In no case did the Alloy 690 welds crack despite test durations eight 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. None of the Alloy 690 welds cracked despite testing durations 24 times longer than for Alloy 600 and 12 times for Alloy 800 and 304 stainless.

Not considered in either study is the effect, if any, 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. However, the strong performance of Alloy 690 suggests there would be minimal effect.

Code Case 2142 lists the American Welding Society (AWS) specification (AWS A5.14) and UNS designation (UNS N06052) for a filler metal such as Inco 52. It establishes the F-No. of this weld metal as F-No. 43 for both procedure and performance qualification purposes. By this set of specifications and F-No. assignment, this material is described for welding purposes as similar in its welding characteristics to many other Code nickel-base filler metals. Thus, the filler metal is 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, there is no reason to prohibit the use of the subject filler metal as a substitute for other weld metals where the licensee has determined that their use could enhance the quality and safety of pressurizer instrument nozzle welds. Further, the staff finds that the Code case appropriately identifies and classifies this filler metal for welding purposes, thereby eliminating the burden that would be imposed by the requirement for special procedure and performance qualifications for non-Code materials. The staff finds that imposition of additional procedure and performance qualifications would not, in this case, result in any increase in quality or safety.

Pursuant to 10 CFR 50.55a(a)(3)(i), permission is granted to employ the alternative welding material of Code Case 2142, and the benefits of this Code case for procedure and performance qualification purposes during the ongoing pressurizer instrument nozzle repairs.

Due to the fact this would be an early use of this filler metal, the staff recommends that the licensee maintain detailed records of individual heat usage locations.

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Date: March 30, 1994