B&W NUCLEAR TECHNOLOGIES

JHT/89-235
November 7, 1989

3315 Old Forest Road
P.O. Box 10935
Lynchburg, VA 24506-0935
Telephone: 804-385-2000
Telecopy: 804-385-3663

50-317/318

U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

Subject: B&W Proposal of Alternative to ASME Boiler and Pressure Vessel Code Section III Requirements

Reference: 1) Letter from Mr. G. C. Creel (Baltimore Gas & Electric) to U. S. NRC Document Control Desk, dated October 27, 1989, "Revision of Proposal of Alternative to ASME Boiler and Pressure Vessel Code Section III Requirements" (copy attached).

Gentlemen:

The purpose of this letter is to request approval for the use of SB-166, UNS NO6690 (Alloy 690) material in fabricating steam generator plugs. As noted in the referenced letter, this material possesses superior corrosion resistance to primary water stress corrosion cracking over Alloy 600, the current material that is used for steam generator plugs. The design values that will be used for code calculations will be based on those given in Code Case N-474, approved for SB-163 material, and Code Main Committee Item 88-360, approved December 9, 1988 for all forms of Alloy 690. The information from 88-360 will be included in the Winter 1989 Addenda of the Section III Appendices.

As material requirements for Alloy 690 are contained within SB-166, this specification, and B&W manufacturing requirements that are more restrictive, will be adhered to for chemical and mechanical properties.

B&W has requested ASME approval for the application of Alloy 690, Specification SB-166, SB-167, SB-168, and SB-564 material for Section III repairs, and the ASME B&PV Code Committee will be reviewing this request.

Your approval of this proposal is requested by December 15, 1989 to allow the use of Alloy 690. The need for this material is based on the recent problems that have been associated with Alloy 600 when used as mechanical steam generator plugs. Therefore, the use of Alloy 690 is the correct choice of material for steam generator plugging applications to avert potential plug cracking concerns.

A001
1/1

Should you have any further questions regarding this matter, we will be pleased to discuss them with you.

By copy of this letter to Mr. J. E. Richardson, he is requested to advise me promptly as to whether a December 15, 1989 approval is feasible. B&W plans to begin installing 690 plugs in January 1990.

Very truly yours,

J. H. Taylor, Manager
Licensing Services

JHT/bcc

Attachment

cc: L. B. Engle/NRC
K. R. Wichman/NRC
J. E. Richardson/NRC
S. P. Hellman
J. R. Bohart
R. B. Borsum

BALTIMORE GAS AND ELECTRIC

CHARLES CENTER • P. O. BOX 1475 • BALTIMORE, MARYLAND 21203

GEORGE C. CREEL
VICE PRESIDENT
NUCLEAR ENERGY
(301) 260-4455

October 27, 1989

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Revision of Proposal of Alternative to ASME Boiler and Pressure Vessel Code Section III Requirements

Gentlemen:

The purpose of this letter is to amend Reference (a) with the following proposal. In accordance with 10 CFR 50.55a(a)(3), we are proposing an alternative to the requirements of 10 CFR 50.55a(c). The original proposal erroneously stated that it was is submitted in accordance with Reference (b).

We have determined that Alloy 690 is superior to Alloy 600 for use as replacement pressurizer penetration material due to its primary water stress corrosion cracking (SCC) resistance. The ASME Boiler and Pressure Vessel (B&PV) Code approves the use of Alloy 690 under Specification SB-163 for Section III (Code Cases N-20-3 and N-474), but Specifications SB-166 and SB-167 are not currently included. We are proposing to use, at our option, Alloy 690 meeting Specification SB-166 or SB-167 instead of Alloy 600 for pressurizer penetration replacements.

I. Components for Which an Alternative is Proposed

The attached drawing identifies all pressurizer penetrations. We plan to use Alloy 690 under Specification SB-166 or SB-167 for any penetration that requires replacement. These penetrations were originally designed to ASME B&PV Code Section III, Class 1, 1965 Edition through Winter 1967 Addenda.

II. ASME Requirement for Which an Alternative is Proposed

We have adopted the alternative allowed by ASME B&PV Code Section XI, 1986 Edition, paragraph IWA-7210(c). The alternative allows that "replacements may meet all or portions of the requirements of later editions of the Construction Code . . . " We have reviewed the ASME B&PV Code Section III and noted that the use of Alloy 690 meeting Specifications SB-166 and SB-167 is not included. Regulatory Guide 1.85 lists Code Case N-20-1 as approved; however, this case

8911060311 5 PP.

applies only to Specification SB-163 seamless tubing for condenser or heat exchanger applications with a 40 ksi minimum yield strength. Additionally, we note that Code Case N-20-1 has expired and has been renewed as N-20-3. Also, Code Case N-474 has recently been approved by the ASME Code Committee (which includes approval by the NRC representative Mr. R. J. Bosnak) during its February 1989 meeting, and will appear in the next ASME B&PV Code Case publication. Again, this Code Case applies only to Specification SB-163, but allows the use of a 35 ksi minimum yield strength material.

III. Basis for Proposing an Alternative

During the current Unit 2 refueling outage, an inservice inspection of the Unit 2 pressurizer discovered evidence of reactor coolant leakage from a number of heater penetrations and one pressurizer pressure/level penetration. Subsequent investigations have revealed that a number of these penetrations must be either repaired or replaced.

The original penetrations are made of Alloy 600. While this material is acceptable as replacement material, the current body of data indicates that Alloy 690 possesses superior SCC resistance. The increased chromium content of Alloy 690 produces a material that has been demonstrated to be immune or at least resistant to degradation mechanisms that are active with Alloy 600. For example, on page 2-9, Reference (c) states, "all available data for Alloy 690 suggests this material ('microstructure') is not susceptible to primary water stress corrorion cracking (PWSCC). Therefore, even though the other factors are present (stress and temperature), PWSCC has not been observed in this alloy." Page 8-1 of Reference (d) concludes, "Alloy 690 was immune to SCC in pure water under all conditions evaluated" and "Ranking of the alloys in terms of their SCC resistance in the simulated resin intrusion environment indicated that . . . Alloy 600 . . . had intermediate resistance, and Alloy 690 . . . had the highest resistance." Page v of Reference (e) states, "Alloy 690 was much more resistant to stress corrosion than Alloy 600 and was immune to cracking in most of the acidic sulfate solutions examined." Also, References (f) and (g) conclude that crack initiation times for Alloy 600 are reduced as the room temperature yield strength and residual stresses are increased. This same relationship would be expected for Alloy 690 material.

Based on the superior stress corrosion cracking resistance properties of Alloy 690, we prefer to use it as the replacement material for our pressurizer penetrations. The ASME B&PV Code Section III allows the use of Alloy 690 under Specification SB-163: Seamless Nickel and Nickel Alloy Condenser and Heat Exchanger Tubes (up to 7/8-inch OD) with a 40 ksi minimum yield strength per ASME Code Case N-20-3. ASME B&PV Code Case N-474 allows the use of 35 ksi minimum yield strength as specified in Specification SB-163 for all applicable tubing thicknesses determined in accordance with NB-3133 using Figure VII-1101-1 in Appendix VII of Section III (References h and i). The ASME B&PV Code, however, does not include use of Specification SB-166: Nickel-Chromium-Iron Alloy Rod, Bar and Wire or Specification SB-167: Nickel-Chromium-Iron Alloys Seamless Pipe and Tube.

Use of Specifications SB-166 and SB-167 will allow us to replace the pressurizer penetrations with Alloy 690.

IV. Additional Requirements

Through this proposal, Specifications SB-166 and SB-167 will be used together with the applicable additional requirements imposed on Specification SB-163 in the ASME B&PV Code Cases N-20-3 and N-474. Specifically, we will adhere to the intent of the ASME B&PV Code Case N-474 (for 35 ksi minimum yield strength material) for mechanical properties. That is, we will meet the minimum yield strength requirements for Alloy 690 as given in Specifications SB-166 or SB-167 for Alloy 600. In addition, we will establish the separate welding procedures and performance qualifications required for Alloy 690 by the ASME B&PV Code Cases.

Your approval of this proposal is requested by December 15, 1989, to allow the use of Alloy 690. Use of this material will provide an acceptable level of quality and safety as described in paragraph III above and further described in References (b), (c) and (d). The need for this request could not reasonably have been anticipated since leakage from pressurizer sleeves or nozzles is a rare occurrence. Compliance with the specified requirements of ASME Code Section III will not result in hardship or unusual difficulty in affecting repairs. However, the use of Alloy 600 may be related to the root cause of the leakage at the pressurizer penetrations. Therefore, the use of Alloy 690 is the correct choice of material for the pressurizer sleeve and nozzle application. Its use will avert the potential future consequences (i.e., hardship) associated with not using the best available material.

Should you have any further questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,

GCC/JMO/dim

List of References

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
R. A. Capra, NRC
S. A. McNeil, NRC
W. T. Russell, NRC
J. R. Strosnider, NRC
D. F. Limroth/J. A. Golla, Jr., NRC
T. Magette, DNR

LIST OF REFERENCES

Baltimore Gas and Electric
Revision of Proposal of Alternative to ASME Boiler and
Pressure Vessel Code Section III Requirements

(a) Letter from Mr. G. C. Creel (BG&E) to NRC Document Control Desk, dated July 13, 1989, Proposal of Alternatives to ASME Code Section III Requirements

(b) NRC Staff Guidance Letter on ASME Relief Requests, dated January 1978

(c) Steam Generator Tube Plug Integrity Summary Report, April 1989, Westinghouse Electric Corporation, WCAP-12244, Revision 1

(d) Stress Corrosion Cracking Resistance of Alloys 600 and 690 and Compatible Weld Metals in BWRs, July 1988, Electric Power Research Institute, NP-5882M Final Report

(e) Stress Corrosion Cracking Resistance of Alloys 600 and 690 in Acidic Sulfate Solutions at Elevated Temperatures, October 1983, Electric Power Research Institute, NP-3043 Final Report

(f) Intergranular Stress Corrosion Cracking in Steam Generator Tubing. Testing of Alloy 690 and Alloy 600 Tubes, K. Norring, et. al., Environmental Degradation of Materials in Nuclear Power Systems- Water Reactors, TMS, 1988

(g) A Comparison of the Stress Corrosion Cracking Behavior of Alloys 600 and 690 in AVT Water, B. P. Miglin and C. E. Shoemaker, Corrosion 86, NACE, March 1986

(h) Cases of ASME Boiler and Pressure Vessel Code, Case N-20-3, November 30, 1988

(i) Cases of ASME Boiler and Pressure Vessel Code, Case N-474, to be published

bcc: G. V. McGowan
C. H. Poindexter
J. A. Tiernan/C. J. Franklin, Jr.
C. H. Cruse/P. E. Katz
R. E. Denton/R. P. Heibel
R. C. DeYoung
R. M. Douglass/R. F. Ash
C. C. Lawrence, III/M. J. Miernicki
F. J. Munno/M. Gavrilas
R. B. Pond/S. R. Burbaum
L. B. Russell/J. R. Lemons
J. M. Zupko, Jr.
W. J. Lippold/B. S. Montgomery
J. H. Walter
R. C. DeYoung
C. M. Rice
R. G. Staker
J. J. Connolly
G. J. Fallbom
D. L. Shaw, Jr.
M. L. Stone
D. V. Graf
B. C. Rudell
T. M. Khan
C. E. Thomas, B&W
D. Firth, B&W

Please be sure to route to your Alternate.