

March 6, 2003

Mr. Fred J. Cayia
Site Vice President
Point Beach Nuclear Plant
Nuclear Management Company, LLC
6610 Nuclear Road
Two Rivers, WI 54241

SUBJECT: POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2 - RELIEF REQUEST NO. 7
USE OF CODE CASE N-616 ALTERNATIVE VISUAL EXAMINATION METHOD
ON BOLTED CONNECTIONS (TAC NOS. MB5407 AND MB5408)

Dear Mr. Cayia:

By letter dated March 22, 2002, the Nuclear Management Company, LLC (the licensee) submitted Relief Request No. 7 (RR-7) which proposed the use of ASME Code Case N-616 at Point Beach Nuclear Plant, Units 1 and 2, as an alternative to the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code*, Section XI, Article IWA-5242(a), as specified in the ASME Code, Section XI, 1998 edition with addenda through 2000, for insulated pressure-retaining bolted connections.

The Nuclear Regulatory Commission (NRC) staff has reviewed RR-7. The NRC staff's safety evaluation is enclosed. Pursuant to 10 CFR 50.55a(a)(3)(i), the proposed alternative, as described in RR-7, is authorized on the basis that the alternative provides an acceptable level of quality and safety. Use of Code Case N-616, "Alternative Requirements for VT-2 Visual Examination of Classes 1, 2, and 3 Insulated Pressure Retaining Bolted Connections," is authorized until such time as Code Case N-616 is published in a future version of Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1." At that time, if the licensee intends to continue implementing this code case, it must follow all provisions of Code Case N-616 with limitations or conditions specified in RG 1.147, if any. The proposed alternative is authorized for the fourth 10-year inservice inspection interval.

Sincerely,

/RA/

L. Raghavan, Chief, Section 1
Project Directorate III
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-266 and 50-301

Enclosure: Safety Evaluation

cc w/encl: See next page

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Point Beach Nuclear Plant, Units 1 and 2

cc:

Mr. John H. O'Neill, Jr.
Shaw, Pittman, Potts & Trowbridge
2300 N Street, NW
Washington, DC 20037-1128

Mr. Richard R. Grigg
President and Chief Operating Officer
Wisconsin Electric Power Company
231 West Michigan Street
Milwaukee, WI 53201

Site Licensing Manager
Point Beach Nuclear Plant
Nuclear Management Company, LLC
6610 Nuclear Road
Two Rivers, WI 54241

Mr. Ken Duveneck
Town Chairman
Town of Two Creeks
13017 State Highway 42
Mishicot, WI 54228

Chairman
Public Service Commission
of Wisconsin
P.O. Box 7854
Madison, WI 53707-7854

Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
801 Warrenville Road
Lisle, IL 60532-4351

Resident Inspector's Office
U.S. Nuclear Regulatory Commission
6612 Nuclear Road
Two Rivers, WI 54241

Ms. Sarah Jenkins
Electric Division
Public Service Commission of Wisconsin
P.O. Box 7854
Madison, WI 53707-7854

Mr. Roy A. Anderson
Executive Vice President and
Chief Nuclear Officer
Nuclear Management Company, LLC
700 First Street
Hudson, WI 54016

Nuclear Asset Manager
Wisconsin Electric Power Company
231 West Michigan Street
Milwaukee, WI 53201

March 2002

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO THE FOURTH INSERVICE INSPECTION INTERVAL

RELIEF REQUEST 7

NUCLEAR MANAGEMENT COMPANY, LLC

POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-266 AND 50-301

1.0 INTRODUCTION

By letter dated March 22, 2002, the Nuclear Management Company, LLC (the licensee) submitted Relief Request No. 7 (RR-7) which proposed the use of ASME Code Case N-616 at Point Beach Nuclear Plant (PBNP), Units 1 and 2, as an alternative to the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code*, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," Article IWA-5242(a), as specified in the ASME Code, Section XI, 1998 edition with addenda through 2000, for insulated pressure-retaining bolted connections.

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.55a(g), requires that inservice inspection (ISI) of the American Society of Mechanical Engineers (ASME) Code Class 1, 2, and 3 components be performed in accordance with Section XI of the ASME Code, Article IWA-5242(a), and applicable addenda, except where relief has been authorized by the Commission pursuant to 10 CFR 50.55a(6)(g)(i). The regulation at 10 CFR 50.55a(a)(3) states that alternatives to the requirements of paragraph (g) may be used, when authorized by the Nuclear Regulatory Commission (NRC), if the licensee demonstrates that (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Pursuant to 10 CFR 50.55a(g)(4), ASME Code Class 1, 2 and 3 components (including supports) shall meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, to the extent practical within the limitations of design, geometry, and materials of construction of the components. The regulations require that inservice examination of components and system pressure tests conducted during the first 10-year interval and subsequent intervals comply with the requirements in the latest edition and addenda of Section XI of the ASME Code incorporated by reference in 10 CFR 50.55a(b) 12 months prior to the start of the 120-month interval, subject to the limitations and modifications listed therein. For the PBNP, Units 1 and 2, the applicable edition of Section XI of the ASME Code for the fourth 10-year ISI interval is the 1998 edition with addenda through 2000.

3.0 EVALUATION

3.1 RR-7 for PBNP, Units 1 and 2

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee requested relief from the requirements of IWA-5242(a) for removing insulation from pressure-retaining bolted connections for VT-2 visual examinations, as specified in the ASME Code, Section XI, 1998 edition with addenda through 2000.

3.2 Components for Which Relief is Requested

Class 1, 2, and 3 pressure-retaining bolted connections.

3.3 ASME Code Requirement from Which Relief is Requested

ASME Code, Section XI, 1998 edition with addenda through 2000, Article IWA-5242(a), requires insulation be removed from pressure-retaining bolted connections for VT-2 visual examinations.

3.4 Licensee's Request for Relief (as stated)

PBNP is requesting relief from removing the insulation at bolted connections in systems borated for the purpose of controlling reactivity as described in IWA-5242(a).

3.5 Licensee's Basis for Requesting Relief (as stated)

Use of this Code Case provides an acceptable level of quality and safety by requiring Section XI examinations to be performed in the same manner as the remainder of the pressure-retaining components. The examinations performed will find evidence of leakage by looking at those areas where water accumulates around leakage sites. This Code Case meets the intent of Section XI, IWA-5240 requirements by requiring PBNP to examine bolted connections by looking at the insulation and areas under the bolted connections for evidence of leakage.

3.6 Licensee's Proposed Alternative Examinations (as stated)

PBNP will use the alternative requirements of ASME Code Case N-616, Alternative Requirements for VT-2 Visual Examination of Classes 1, and 2, and 3 Insulated Pressure Retaining Bolted Connections.

In addition to the requirements of Code Case N-616, PBNP will perform the following:

1. Insulation will be removed for VT-2 visual examination during the system pressure test for any 17-4 PH stainless steel or 410 stainless steel stud or bolt aged at a temperature below 1100 degrees F or with hardness above R_c 30.

2. For A-286 stainless steel studs or bolts, the preload must be verified to below 100 Ksi or the thermal insulation must be removed and the joint visually examined.
3. For nuts conforming to SA-194, removal of the insulation for visual examination will not be necessary.
4. A 4-hour hold time at operating temperature and pressure will be performed prior to conducting VT-2 examination.

3.7 NRC Staff Evaluation

The ASME Code, Section XI, Article IWA-5250(a)(2), requires the removal of all insulation from pressure-retaining bolted connections in systems boroated for the purpose of controlling reactivity when performing VT-2 visual examinations during system pressure tests. The Code requires this examination to be performed each refueling outage for Class 1 systems and each inspection period for Class 2 and 3 systems. The licensee has requested relief from the Code requirements to use Code Case N-616. Code Case N-616 was approved by the ASME on May 7, 1999, but as of the date of the licensee's submitted RR, has not yet been reviewed by the NRC staff for general applicability.

The NRC staff has developed positions over the years on the use of AISI Type 17-4 PH stainless steel (SA-564 Grade 630), AISI Type 410 stainless steel (SA-193 Grade 6), and A-286 stainless steel (SA-453 Grade 660) fasteners. The 17-4 PH stainless steel and 410 stainless steel are suitable for use in contact with primary water if they are aged at a temperature of 1100 °F or higher. If they are aged at a lower temperature, they become susceptible to primary water stress corrosion cracking. The hardness of these alloys should be below R_c 30 if they are properly heat treated. A-286 stainless steel is susceptible to stress corrosion cracking in primary water, particularly if preloaded above 100 ksi. NUREG/CR-3604, "Bolting Applications," states that A-286 stainless steel is not suitable for use as a reactor structural material because much safer materials are available. However, there is a large number of A-286 bolting currently in nuclear service, both in boiling-water reactors (BWRs) and pressurized-water reactors (PWRs). Bengtsson and Korhonen of ASEA-ATOM, Vasteras, Sweden, examined the behavior of A-286 in a BWR environment¹. They found that A-286 stainless steel, in comparison to other tested materials, was the most susceptible material they tested to intergranular stress corrosion cracking in BWR water. They also found that A-286 stainless steel is less likely to crack as the applied stress is reduced. Piascik and Moore from Babcock & Wilcox reported a number of vessel internals bolt failures of A-286 bolts in PWR water in Nuclear Technology, Vol. 75, December 1986. They correlated the failures with bolt fillet peak stress and found that bolts preloaded below 100 ksi showed no failures.

¹ As reported in the *Proceedings of the International Symposium on Environmental Degradation of Materials in Nuclear Power Systems-Water Reactors*, August 22-25, 1983, Myrtle Beach, South Carolina, sponsored by the National Association of Corrosion Engineers, the Metallurgical Society of AIME, and the American Nuclear Society.

The NRC staff position is that any 17-4 PH stainless steel or 410 stainless steel stud or bolt aged at a temperature below 1100 °F or with hardness above R_c 30 must have the thermal insulation removed for VT-2 examination during the system pressure test. For A-286 stainless steel studs or bolts, the preload must be verified to be below 100 ksi or the thermal insulation must be removed and the joint visually inspected. For nuts conforming to SA-194, experience indicates it would not be necessary to remove the thermal insulation for visual inspection.

Code Case N-616 does not address the possibility that 17-4 PH stainless steel, 410 stainless steel, or A-286 fasteners could fail in service under insulation and the failure could go unnoticed. Also, all valve bodies, pump casings, and piping must contain at least 10 percent chromium and be in the proper heat treatment condition because the insulation could create an autoclave and materials with less than 10 percent chromium could experience high corrosion rates. This corrosion could go unnoticed. It also does not specifically require the 4-hour hold time at operating temperature and pressure prior to conduction the VT-2 examination. Although Code Case N-616 does not address these concerns, the licensee has addressed them as indicated above in section 3.6. The information provided satisfies the NRC staff's concerns. The NRC staff finds RR-7 acceptable.

4.0 CONCLUSION

The licensee's proposed alternative provides an acceptable level of quality and safety. Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee's proposed alternative is authorized for the fourth ISI interval at PBNP Units 1 and 2, or until such time as Code Case N-616 is published in a future version of Regulatory Guide 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1." After that time, if the licensee wishes to continue to use Code Case N-616, it must follow all conditions and limitations, if any, listed in the regulatory guide.

Principle Contributors: J. Lamb
D. Spaulding

Date: March 6, 2003