

April 18, 2000

Mr. Michael B. Sellman
Senior Vice President and
Chief Nuclear Officer
Wisconsin Electric Power Company
231 West Michigan Street
Milwaukee, WI 53201

SUBJECT: POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2 - SAFETY EVALUATION
REGARDING REQUEST FOR RELIEF TO USE ALTERNATIVE MATERIAL FOR
THE REACTOR VESSEL HEAD PENETRATION ADAPTER PLUGS
(TAC NOS. MA6320 AND MA6321)

Dear Mr. Sellman:

By letter dated August 16, 1999, Wisconsin Electric Power Company (the licensee) submitted a request for relief. The licensee requested to use alternative material from those listed in American Society of Mechanical Engineers (ASME) Code, Section III, 1965 edition, for the reactor vessel head penetration adapter plugs. Specifically, the licensee requested to use ASTM A 276 type 304 material instead of ASME SA 182 type 304 material.

The staff has completed its review of the information provided by the licensee and finds that the licensee has provided an acceptable alternative to the requirements of ASME Code, Section III, 1965 edition. The staff therefore concludes that authorization of the licensee's alternative would provide an acceptable level of quality and safety, is authorized by law and will not endanger life or property or common defense and security. Accordingly, pursuant to 10 CFR 50.55a(a)(3)(i), the alternative is authorized. The enclosure documents our evaluation.

Sincerely,

/RA/

Claudia M. Craig, 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

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November 1999

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR APPROVAL OF ALTERNATIVE MATERIAL FOR THE

REACTOR VESSEL HEAD PENETRATION ADAPTER PLUGS

WISCONSIN ELECTRIC POWER COMPANY

POINT BEACH NUCLEAR PLANT, UNITS 1 AND 2

DOCKET NOS. 50-266 AND 50-301

1.0 INTRODUCTION

The regulation in 10 CFR 50.55a requires that systems and components of nuclear power plants are designed and constructed in accordance with the rules provided in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME Code), Section III, Division 1, 1965 edition. Pursuant to 10 CFR 50.55a(3), proposed alternatives to the ASME Code requirements can be used when authorized by the NRC if the licensee demonstrates that: (1) the proposed alternative would provide an acceptable level of quality and safety, or (2) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Wisconsin Electric Power Company (the licensee) while investigating the heat treatment condition of the reactor vessel head adapter plugs at Point Beach Nuclear Plant (PBNP), Units 1 and 2, discovered that the plugs were fabricated from American Society for Testing and Materials (ASTM) A 276 type 304 material instead of ASME SA 182 type 304 material, as called out in Westinghouse drawing 883D194. Specifically, the reactor vessel head adapter plugs are required to meet the requirements of the ASME Code. Table N-422 of the ASME Code lists the SA-182 type 304 material, whereas ASTM A 276 type 304 material is not referenced. Thus, the plugs do not meet the ASME Code requirements. In a letter dated August 16, 1999, the licensee requested that the NRC approve the use of ASTM A 276 type 304 material as an alternative material for the reactor vessel head adapter plugs.

2.0 EVALUATION

The licensee submitted to the NRC a relief request to use alternative materials for the reactor vessel head adapter plugs at PBNP, Units 1 and 2. The information provided by the licensee in support of its request for relief has been evaluated and the bases for the NRC staff's disposition are documented below.

ENCLOSURE

2.1 Code Requirement:

The ASME Code, Section III, Article N-310 states, "Any pressure-boundary material, or material welded thereto, except as provided in N-518.2, used under the rules of Subsection A shall conform to the requirements of one of the specifications for materials in Tables N-421, N-422, and N-423 and to all the special requirements of Article 3 which apply to the product form in which the material is used." Table N-422 lists requirements for SA-182 type 304 material, but does not include A 276 type 304 material.

2.2 Licensee's Code Relief Request:

Pursuant to 10 CFR 50.55a(a)(3)(i), the licensee requested relief from the ASME Code requirement to use SA-182 type 304 material for the reactor vessel head penetration adapter plugs and requested that the NRC approve the use of ASTM A 276 type 304 material instead.

2.3 Licensee's Basis for Requesting Relief:

The head adapter plugs are currently installed on the reactor vessel and constitute part of the reactor vessel pressure boundary. The reason for the proposed alternate requirement is based on the following:

- 1) The replacement of the head adapter plugs would result in excessive radiation exposure to plant personnel. A replacement of four part-length control rod drives with head adapter plugs in 1997 using remotely operated tooling resulted in radiation exposure of 12 rem to personnel performing the job. Therefore, it is estimated that the exposure to replace the spare penetrations are 3 man-rem/adapter plug or a total of 36 rem to replace all twelve head adapter plugs.
- 2) The current material installed (ASTM A 276 Type 304) is considered to be functionally equivalent to the ASME Section III accepted code material of SA 182 Type 304. Comparison studies of the requirements for the type 304 austenitic stainless steel by the two material specifications, A 276 and SA 182, indicate that there is essentially no difference in terms of material chemistry and mechanical requirements. It was found that there are two other requirements that are different: a) minimum annealing temperature and b) macro-etch test.

The minimum annealing temperature required for the SA 182 forging is 1900°F. Industry recommended practice for the annealing of austenitic stainless steel is from 1850°F to 2050°F. Based on the recommended temperature range there is about a 50°F difference in the minimum annealing temperature between A 276 and SA 182 specifications. The difference in minimum annealing temperatures can make a difference in grain size, which in turn would affect the mechanical properties of the material. However, this is not considered significant since the comparison of the mechanical properties shows no indication of any difference.

The macro-etch required by SA 182 specification of the 1965 edition was intended for detecting evidence of laminations, cracks and segregation in case there is any dispute on the soundness of the forging manufactured under the specification. The head adapter plugs had an ultrasonic examination performed prior to machining and a surface

examination (liquid penetrant) after machining. These tests are considered adequate to satisfy the intent of the macro-etch test. A review of the fabrication records by Westinghouse confirmed these tests were performed and the results acceptable.

- 3) Tests were conducted on spare adapter plugs fabricated of A 276 Type 304. The test results included chemical analysis that confirmed the equivalence in composition requirements for SA 182 Type 304. The metallography and intergranular corrosion susceptibility evaluation was performed and results did not indicate any adverse microstructures or evidence of intergranular attack. These results indicate that the material is in the proper annealed condition. The A 276 Type 304 adapters meet the tensile requirements for SA 182 Type 304. In conclusion, testing and metallographic analysis demonstrates the A 276 Type 304 material is functionally equivalent to A 182 Type 304.
- 4) The connection between the head adapter plug and the spare penetration is made by mechanical threads. A seal weld is made between the head adapter plug and the spare penetration to prevent leakage of water containing boron onto the reactor vessel head. The seal welding does not affect any of the material properties of the pressure retaining portion of the head adapter plug.

Based on the above, the currently installed A 276 Type 304 head adapter plugs are considered functionally equivalent to the SA 182 Type 304 material and provide an acceptable level of quality and safety.

2.4 Licensee's Proposed Alternative Requirement:

The proposed alternate to the ASME Section III code requirement is to use material A-276 Type 304 for the reactor vessel head adapter plugs. This material is not listed in Tables N-421, N-422 or N-423.

2.5 Evaluation:

The licensee has requested relief from the ASME Code requirements to use A-276 type 304 material for the reactor vessel head adapter plugs. This material is not listed in Tables N-421, N-422, or N-423. The reactor vessel head adapter plugs are used to provide a Class I pressure boundary for control rod drive mechanism vessel head penetrations that are functionally inactive. The head adapter plug is designed and fabricated to the requirements of ASME Code, Section III, Subsection NB. The adapter plug is threaded onto spare head penetrations and seal-welded to prevent any leakage past this connection. The pressure boundary is maintained by the threads. There are four head penetrations on Unit 2 and eight head penetrations on Unit 1. The licensee discovered that alternative material has been installed while investigating the heat treatment condition of the head adapter plugs. The investigation revealed that the plugs were fabricated from ASTM A 276 type 304 material in lieu of SA 182 type 304 material, as called out in Westinghouse drawing 883D194. The licensee evaluated the suitability of ASTM A 276 type 304 material using tests that were conducted on spare adapter plugs fabricated of A 276 type 304. The test included a chemical analysis, a metallography, and an intergranular corrosion susceptibility evaluation. The test results indicated that the material is in proper annealed condition. The A 276 type 304 adapters also meet the tensile requirements specified for SA 182 type 304 material. The licensee concluded that ASTM A 276 type 304 material is functionally equivalent to SA 182 type 304 material and, therefore, the material is

acceptable for use as reactor vessel head adapter plugs. The NRC staff agrees with the licensee's conclusion that ASTM A 276 type 304 material is an acceptable alternative to SA 182 type 304 material because the licensee has demonstrated that the material has been properly solution annealed and nondestructively examined prior to placement in service. Properly solution annealed material is resistant to service cracking and thus, the integrity of the reactor vessel head adapter plugs is maintained in service.

3.0 CONCLUSION

The NRC staff finds that the licensee has provided an acceptable alternative to the requirements of the ASME Code, Section III, 1965 edition. The staff therefore concludes that authorization of the licensee's alternative would provide an acceptable level of quality and safety, is authorized by law and will not endanger life or property or common defense and security. Accordingly, pursuant to 10 CFR 50.55a(a)(3)(i), the alternative is authorized.

Principal Contributor: G. Georgiev

Date: April 18, 2000