

January 28, 2002

Mr. Ted C. Feigenbaum  
Executive Vice President and  
Chief Nuclear Officer  
North Atlantic Energy Service Corporation  
c/o Mr. James M. Peschel  
P.O. Box 300  
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SUBJECT: SEABROOK STATION, UNIT NO. 1 - INSERVICE INSPECTION (ISI)  
PROGRAM RELIEF REQUESTS 2AR-03, 2AR-04, 2AR-05, AND 2IR-14  
(TAC NO. MB2421)

Dear Mr. Feigenbaum:

By letter dated July 18, 2001, North Atlantic Energy Service Corporation requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code. The requests were made under the provisions of Section 50.55a(a)(3)(i) of Title 10 of the *Code of Federal Regulations* (10 CFR). In a telephone call on November 5, 2001, the staff requested certain additional information regarding your relief request 2IR-14. In a telephone call on or about November 19, 2001, Mr. Jeff Sobotka of your staff stated that relief request 2IR-14 may be resubmitted in the future with the requested information; therefore, relief request 2IR-14 is not considered in the enclosed safety evaluation.

The staff concludes that the alternatives proposed in Relief Requests 2AR-03, 2AR-04, and 2AR-05 will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternatives for the second 10-year ISI interval at Seabrook Station, Unit No. 1. The staff's safety evaluation is enclosed. This completes the staff's efforts on TAC No. MB2421.

Sincerely,

**/RA/**

James W. Clifford, Chief, Section 2  
Project Directorate I  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-443

Enclosure: Safety Evaluation

cc w/encl: See next pages

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

FOR SECOND 10-YEAR INTERVAL INSERVICE INSPECTION PROGRAM

REQUESTS FOR RELIEF 2AR-03, 2AR-04, AND 2AR-05

SEABROOK STATION, UNIT NO. 1

NORTH ATLANTIC ENERGY SERVICE CORPORATION

DOCKET NO. 50-443

1.0 INTRODUCTION

The Inservice Inspection (ISI) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code) Class 1, 2, and 3 components is to be performed in accordance with Section XI of the ASME Code and applicable edition and addenda as required by Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(g) except where specific relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i). The regulation at 10 CFR 50.55a(a)(3) states in part that alternatives to the requirements of paragraph (g) may be used, when authorized by the U.S. 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) will meet the requirements, except the design and access provisions and the preservice examination requirements, set forth in the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 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. The ISI code of record for Seabrook Station, Unit No. 1 second 10-year ISI interval is the 1995 Edition through the 1996 Addenda of Section XI of the ASME Boiler and Pressure Vessel Code.

By letter dated July 18, 2001, North Atlantic Energy Service Corporation (the licensee) requested approval to use ASME Code Case N-566-1 as an alternative to paragraph IWA-5250(a)(2), (2AR-03); approval to use Code Case N-616 as an alternative to paragraph IWA-5242(a) for examination categories B-P, C-H, and D-B (2AR-04); approval to use Code Case N-623 as an alternative to the scheduling requirements for the Reactor Pressure

Enclosure

Vessel (RPV) Shell-to Flange and Head-to-Flange welds contained in Examination Category B-A (2AR-05); and approval to use the best available technique for single-sided access welds subject to ultrasonic examination with Supplement 2 of Appendix VIII of ASME Section XI.

## 2.0 EVALUATION

### 2.1 Inservice Inspection Program Alternative Request 2AR-03, Revision 0, Use Of Code Case N-566-1 For Leakage At a Bolted Connection

#### Code Requirements for which Relief is Requested (as stated):

ASME Boiler and Pressure Vessel (B&PV) Code Section XI, 1995 Edition through the 1996 Addenda, paragraph IWA-5250(a)(2) states that if leakage occurs at a bolted connection on other than a gaseous system, one of the bolts shall be removed, VT-3 examined, and evaluated in accordance with IWA-3100. The bolt selected shall be the one closest to the source of leakage. When the removed bolt has evidence of degradation, all remaining bolting in the connection shall be removed, VT-3 examined, and evaluated in accordance with IWA-3100.

#### Licensee's Proposed Alternative to Code (as stated):

The alternative rules set forth in Code Case N-566-1 such that:

- (a) The leakage shall be stopped, and the bolting and component material shall be evaluated for joint integrity as described in (c) below.
- (b) If the leakage is not stopped, the joint shall be evaluated in accordance with IWB-3142.4 for joint integrity. This evaluation shall include the considerations listed in (c) below.
- (c) The evaluation of (a) and (b) above is to determine the susceptibility of the bolting to corrosion and failure. This evaluation shall include the following:
  - (1) the number and service age of the bolts;
  - (2) bolt and component material;
  - (3) corrosiveness of process fluid;
  - (4) leakage location and system function;
  - (5) leakage history at the connection or other system components;
  - (6) visual evidence of corrosion at the assembled connection.

If the evaluation determines that examination is required, the bolt closest to the leak will be removed and VT-1 examined. The bolt will be evaluated in accordance with IWB-3517.1 of the ASME B&PV Code Section XI, 1995 Edition through the 1996 Addenda.

#### Licensee's Basis for Relief (as stated):

Pursuant to 10 CFR 50.55a(a)(3)(ii), authorization is sought to utilize ASME Code Case N-66-1 as an alternative to the requirements specified in the ASME B&PV Code Section XI, 1995 Edition through the 1996 Addenda, Paragraph IWA-5250(a)(2).

A number of problems have been identified with this requirement:

- IWA-5250(a) directs that a VT-3 be performed on the removed bolt in accordance with IWA-3100. IWA-3100 does not contain acceptance criteria for VT-3 of bolting.
- The Code does not require that the leakage be stopped; therefore, after pulling and examining the bolt, the leakage may continue.
- Removing one bolt at a time, the leakage may become even worse than originally found.
- The Code does not address integrity of the joint.
- Bolts can be damaged when being removed.
- The Code requires removing the bolting even if the leakage is minor, can be monitored, or if there is no corrosion concern. This can impact startup, impact personnel safety, cause hardship, and increase radiation exposure without a commensurate increase in safety.

A Special Task Group within the ASME B&PV Code Section XI Subcommittee has addressed through-wall and mechanical joint leakage. They have concluded that structural integrity does not imply leak tightness. IWB-3142.4 allows acceptance of relevant conditions by analytical evaluation. It is felt that this can be applied to leakage from mechanical connections.

It is the North Atlantic position that compliance with the existing ASME Code requirement results in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The proposed alternative in the Code Case provides a level of quality and safety equivalent to other components evaluated under IWB-3142.4.

#### Staff Evaluation

IWA-5250(2) requires that all bolts be removed from leaking bolted connections and that the bolts be VT-3 visual examined for corrosion and evaluated in accordance with IWA-3100. The Code requirements provide assurance that bolting corroded by system leakage will be detected and that corrective actions will be taken. This paragraph of the Code does not take into account the location of the leakage, nor does it allow an engineering evaluation as allowed for other components with unacceptable conditions. This is inconsistent with the rest of the Code which allows engineering evaluation for continued service as described under paragraph IWB-3142.4; furthermore, removal and examination of all bolts may not be necessary to ensure continued integrity of the bolted connection.

In lieu of these requirements, Code Case N-566-1 is an alternative which requires, in part, an engineering evaluation under IWB-3142.4 taking into consideration the following elements:

1. Location of leakage
2. History of leakage
3. Fastener materials
4. Evidence of corrosion, with the connection assembled
5. Corrosiveness of the process fluid, and,
6. Other components in the vicinity that may be degraded due to the leakage

If the analytical evaluation results in the bolting being acceptable for continued service, the bolted connection will be subsequently examined in accordance with IWB-2420(b) and (c). The staff considers this a reasonable approach, consistent with the rest of the Code when evaluating components for continued service.

Based on the discussion above, the staff concludes that the use of Code Case N-566-1 under the alternative proposed in Alternative Request 2AR-03, Revision 0, will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative for the second 10-year ISI interval at Seabrook Station, Unit No. 1.

## 2.2 Inservice Inspection Program Alternative Request 2AR-04, Revision 0, Use Of Code Case N-616, Alternative Requirements For VT-2 Visual Examination of Class 1, 2, and 3 Insulated Pressure Retaining Bolted Connections

### Code Requirements for which Relief is Requested (as stated):

1995 Edition, 1996 Addenda of the ASME Boiler and Pressure Vessel (B&PV) Code Section XI:

Table IWB-2500-1 requires the Class 1 connections be VT-2 examined each refueling outage. Tables IWC-2500-1 and IWD-2500-1, for Class 2 and 3 connections respectively, require that Class 2 and 3 connections be VT-2 examined each inspection period.

Subparagraph IWA-5242(a): 'For systems borated for the purpose of controlling reactivity, insulation shall be removed from pressure retaining bolted connections for VT-2 visual examination.

### Licensee's Proposed Alternative to Code (as stated):

North Atlantic will implement ASME Code Case N-616 for performance of VT-2 visual examination at locations where corrosion resistant bolting is installed without removal of the insulation. The following restrictions will apply to those locations where this alternative request is used:

1. A four-hour hold time at system NOP will be utilized prior to examination.
2. This alternative request will not apply to:
  - (a) AISI Type 17-4 stainless steel (SA-564 Grade 630) bolting that was not aged at temperature of 1100°F or higher.
  - (b) AISI Type 410 stainless steel (SA-193 Grade 6) bolting that was not aged at a temperature of 1100°F or higher.
  - (c) A-286 stainless steel (SA-453 Grade 660) that is preloaded to greater than 100 ksi.

3. Use of Code Case N-616 will also only apply to bolted connections where the associated piping, valve bodies, and pump casings contain a minimum of 10% chromium.

If evidence of leakage is detected at locations where corrosion resistant bolting material is used, either by discovery of active leakage or evidence of boric acid crystals, the insulation will be removed and the bolted connection will be reexamined. If necessary, the bolted connection will be evaluated in accordance with the corrective measures of subarticle IWA-5250, as modified by North Atlantic Alternate Request 2AR-03 (Code Case N-566-1, pending NRC approval).

Licensee's Basis for Relief (as stated):

Pursuant to 10 CFR 50.55a(a)(3)(i), authorization is sought to utilize ASME Code Case N-616 as an alternative to the requirements specified in the ASME B&PV Code Section XI, 1995 Edition through the 1996 Addenda, Subparagraph IWA-5242(a). It is the North Atlantic position that the use of Code Case N-616 for VT-2 visual examination without the removal of insulation when the bolting material is resistant to boric acid degradation provides an acceptable level of quality and safety. Corrosion resistant bolted connections on borated systems consist of materials with chromium content greater than or equal to 10%, which are resistant to boric acid degradation. The basis for a minimum chromium content being used as a measure of susceptibility to degradation is established in Code Case N-616. During the last refueling outage OR07, Class 1 bolted connections were inspected with insulation removed in accordance with IWA-5242(a) and North Atlantic Alternative Request 2AR-01 (Code Case N-533). Where boric acid residues were discovered and corrosion resistant bolting removed, no degradation was evident on the bolting material. These results were consistent with expectations that no boric acid corrosion degradation mechanism exists on the corrosion resistant materials.

North Atlantic contends that unnecessary physical hazard and radiation exposure exists to personnel in erecting and removing scaffolding, and removing and reinstalling insulation at nominal operating pressures and elevated temperatures.

North Atlantic conducts pressure tests utilizing a four-hour hold time on systems borated for the purpose of controlling reactivity. This commitment was made to the NRC and published in safety evaluation dated October 17, 2000, TAC No. MA8991. The four-hour hold time prior to examination is also included in this alternative request.

Staff Evaluation

Cold working of the material that ultimately leaves the surface in tension provides a driving force for accelerated cracking. Heat treatment that does not sufficiently anneal the material to increase toughness leaves the material brittle and more susceptible to cracking; therefore, in employing Code Case N-616 certain actions must be taken in order to ensure that these factors

are addressed. The staff concludes the use of Code Case N-616 is acceptable provided the following conditions are met:

1. Insulation must be removed for VT-2 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 1,100 °F or with hardness above  $R_c$  30.
2. 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 examined.
3. For nuts conforming to SA-194, removal of the insulation for visual inspection is not necessary.
4. A 4-hour hold time at operating temperature and pressure is required prior to conducting the VT-2 examination.

The licensee has committed to meeting these conditions. Therefore, the use of Code Case N-616 with the limitations committed to by the licensee is acceptable.

Based on the previous discussion, the staff concludes that the use of Code Case N-616 with the limitations committed to by the licensee under the alternative proposed in Alternative Request 2AR-04, Revision 0, will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative for the second 10-year ISI interval at Seabrook Station, Unit No. 1.

### 2.3 Inservice Inspection Program Alternative Request 2AR-05, Revision 0, Use Of Code Case N-623, Deferral Of Inspections Of Shell-To-Flange And Head-To-Flange Welds Of A Reactor Vessel

#### Code Requirements for which Relief is Requested (as stated):

Section XI of the ASME Boiler and Pressure Vessel (B&PV) Code, 1995 Edition through the 1996 Addenda, Table IWB-2500-1, Category B-A requires that the reactor pressure vessel (RPV) shell-to-flange weld be volumetrically examined once each inspection interval and the RPV head-to-flange weld be surface and volumetrically examined once each inspection interval. The footnotes to the Table provide partial deferrals for both of these welds, but in no case are they allowed to be totally deferred to the end of the interval.

#### Licensee's Proposed Alternative to Code (as stated):

North Atlantic is presently in its second interval for the ISI program. During the first interval ISI, neither the shell-to-flange weld nor the head-to-flange weld contained identified flaws or relevant conditions that required successive inspections in accordance with IWB-2420(b). In preparation for the 10-year RPV examination, a weld map was obtained depicting fabrication radiographic weld repair locations. Both the shell-to-flange and head-to-flange welds had no documented repair areas. In addition, these welds have not been subject to repair/replacement activities during the first interval. As a result, North Atlantic meets these conditions for Seabrook Station. Total deferral of these examinations to the end of the inspection interval would allow the RPV ultrasonic examinations to be

scheduled, in aggregate, at the same time and would result in a significant burden reduction with no change to the examination methods or techniques required under the 1995 Edition through the 1996 Addenda of Section XI.

Performing ultrasonic examination of RPV welds at one time, on a specific RPV, will improve reliability and reproducibility of ultrasonic examinations since the procedures and techniques utilized on the population of welds will be at a uniform level of technology. The experience to date indicates that examinations performed on these shell-to-flange and head-to-flange welds have not identified any detrimental flaws or relevant conditions and that changing the schedule for examining these welds in aggregate at the end of successive 10-year intervals should provide an equivalent indication of the RPV integrity for a specific RPV. Therefore, it is the North Atlantic position that this request meets the provisions of 10 CFR 50.55a(a)(3)(i) as providing an acceptable level of quality and safety.

Licensee's Basis for Relief (as stated):

Pursuant to 10 CFR 50.55a(a)(3)(i), authorization is sought to utilize ASME Code Case N-623 as an alternative to the requirements specified in the ASME B&PV Code Section XI, 1995 Edition through the 1996 Addenda.

Code Case N-623 provides an alternative to the examination scheduling requirements for the RPV shell-to-flange and head-to-flange welds contained in Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel." Currently, these examinations may be partially deferred to the end of a 10-year Inservice Inspection (ISI) Interval, but total deferral is not allowed. Code Case N-623 provides an option to the Owner for total deferral of these weld examinations provided three basic conditions are met:

1. No welded repair/replacement activities have ever been performed on the shell-to-flange or head-to-flange weld;
2. Neither the shell-to-flange weld nor the head-to-flange weld contains identified flaws or relevant conditions that currently require successive inspections in accordance with IWB-2420(b); and
3. The vessel is not in the first inspection interval.

Staff Evaluation

The ASME Code, Section XI, 1989 Edition, Table IWB-2500-1, requires that the RPV shell-to-flange weld be volumetrically examined once each inspection interval and the RPV head-to-flange weld be surface and volumetrically examined once each inspection interval. The footnotes to Table IWB-2500-1 provide partial deferrals for both of these welds. Footnote (3) specifies that during the first and second period, the examination may be performed from the flange face, and the remaining volumetric examinations required to be conducted from the vessel wall may be performed at or near the end of the inspection interval. Footnote (4) provides deferral of the shell-to-flange welds stating that the examinations may be performed during the first and third periods, provided at least 50% of the shell-to-flange welds be examined by the end of the first period, and the remainder by the end of the third inspection period.

The licensee proposes to follow the requirements of Code Case N-623. The staff finds the licensee meets the requirements listed in Code Case N-623 and that deferral of the weld examinations to the end of the inspection interval is supported by the operating history of the industry. The industry experience to date indicates that examinations performed on the reactor pressure vessels shell-to-flange and head-to-flange welds have not identified any detrimental flaws or relevant conditions and that changing the schedule for examining these welds to the end of the licensee's 10-year ISI will provide a suitable frequency for verifying the integrity of the subject welds. The subject welds will still receive the same examinations that have been required by the ASME Code Section XI since the reactor was placed in commercial service. The only change is that the RPV shell-to-flange weld and the RPV head-to-flange welds examinations will be deferred to the end of the inspection interval without conducting partial examinations from the flange face earlier in the inspection interval. No changes are being made to the volumes or areas of material that are examined, nor to the nondestructive examination (NDE) personnel qualifications. This relief request does not involve changes to NDE methods or acceptance criteria.

The staff concludes that the licensee's proposed alternative to use Code Case N-623 provides an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternative for the second 10-year ISI interval at Seabrook Station, Unit No. 1.

#### 2.4 Relief Request 2IR-14, Revision 0; Relief From Procedure Qualification Requirements For Single-Sided Volumetric Examination

In a telephone call on November 5, 2001, the staff requested additional information regarding this relief request. The licensee may resubmit this request with the requested additional information at a later date.

### 3.0 CONCLUSION

Based on the previous discussions, the staff concludes that the alternatives proposed in ISI Program Relief Requests 2AR-03, 2-AR-04, and 2AR-05, will provide an acceptable level of quality and safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the proposed alternatives for the second 10-year ISI interval at Seabrook Station, Unit No. 1.

Principal Contributor: T. Steingass

Date: January 28, 2002