

September 20, 2000

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  
Seabrook, NH 03874

SUBJECT: SEABROOK NUCLEAR POWER STATION - REACTOR VESSEL INSPECTION  
ALTERNATIVE AND RELIEF REQUESTS (TAC NO. MA8618)

Dear Mr. Feigenbaum:

On April 14-19, 1999, the North Atlantic Energy Service Corporation (NAESC, the licensee) performed augmented inspections of the full penetration welds in the Seabrook Station reactor pressure vessel (RPV), as required by the provisions in Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(6)(ii)(A)(2). During the inspections, NAESC determined that it could not achieve the 90-percent cumulative weld volume required by the rule for the inspections that were completed on the vessel's lower-head-to-lower-shell circumferential weld (RPV weld 104-141). On March 21, 2000, NAESC submitted a request for approval of an alternate program (Alternate Request IR-9, Revision 0) for complying with this requirement. In Alternative Request IR-9, Revision 0, NAESC proposed that 73-percent inspected weld volume achieved during the volumetric examinations of the weld, when taken in context with the results of VT-3 type visual examinations performed in accordance with the American Society of Mechanical Engineers (ASME) Section XI, Category B-N-1, Item B13.10, and with the result of reactor coolant system leak tests and VT-2 type visual examinations performed in accordance with ASME Section XI, Category B-P, Item 15.10, would provide a reasonable assurance that the structural integrity of the RPV will be maintained over the remaining operating term of the plant, and provides an acceptable level of quality and safety in lieu of complying with the 90-percent cumulative weld volume requirement of 10 CFR 50.55a(g)(6)(ii)(A)(2).

In the letter of March 21, 2000, NAESC also requested relief (Relief Request IR-10, Revision 0) from complying with the requirements of ASME Section XI, Examination Category B-A, Item B1.11, for circumferential weld 104-141, and with the requirements of ASME Section XI, Examination Category B-A, Item B1.21, for circumferential weld 102-151 (the lower head circumferential weld). In Relief Request IR-10, Revision 0, NAESC stated that it could not achieve the essentially 100-percent weld volume coverages required by the criteria for the inspection categories. Instead, NAESC stated that the weld volumes achieved during the volumetric examinations of the welds performed during the first 10-year Inspection Interval (April 1999) were 73 percent for weld 104-141, and 61 percent for weld 102-151, respectively, and that these weld volumes, when taken in context of the results of visual examinations and pressure tests on the welds, would provide a reasonable assurance that the structural integrity of the RPV will be maintained over the remaining operating term of the plant, and provides an acceptable level of quality and safety in lieu of complying with the stated code requirements.

T. Feigenbaum

- 2 -

The staff has completed its review of NAESC's requests. The staff concludes that NAESC's proposed alternative in Alternative Request IR-9, Revision 0, is authorized pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5) and 10 CFR 50.55a(a)(3)(ii), and that the proposed alternative in Relief Request IR-10, Revision 0, is authorized pursuant to 10 CFR 50.55a(a)(3)(ii).

The Nuclear Regulatory Commission (NRC) staff's evaluation and conclusions are contained in the enclosure. Contact the NRC Project Manager, Robert M. Pulsifer, at (301) 415-3016 if there are any questions. This completes the staff's effort on TAC No. MA8618.

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 page

The staff has completed its review of NAESC's requests. The staff concludes that NAESC's proposed alternative in Alternative Request IR-9, Revision 0, is authorized pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5) and 10 CFR 50.55a(a)(3)(ii), and that the proposed alternative in Relief Request IR-10, Revision 0, is authorized pursuant to 10 CFR 50.55a(a)(3)(ii).

The Nuclear Regulatory Commission (NRC) staff's evaluation and conclusions are contained in the enclosure. Contact the NRC Project Manager, Robert M. Pulsifer, at (301) 415-3016 if there are any questions. This completes the staff's effort on TAC No. MA8618.

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 page

**DISTRIBUTION:**

PUBLIC	RPulsifer	TClark
PDI-2 Rdg.	OGC	JLinville, RGN-I
EAdensam (EGA1)	ACRS	GHill(2)
JClifford	KWichman	JShea, EDO

ACCESSION NO. ML003742325

\*See previous concurrence.

OFFICE	PDI-2/PM	PDI-2/LA	EMCB/SC	OGC	PDI-2/SC
NAME	RPulsifer	TClark	KWichman*	RHoefling*	JClifford
DATE	9/14/00	9/14/00	08/29/00	09/12/00	9/18/00

OFFICIAL RECORD COPY

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SEABROOK NUCLEAR POWER STATION

NORTH ATLANTIC ENERGY SERVICE CORPORATION

DOCKET NO. 50-443

OPERATING LICENSE NO. NPF-86

1.0 INTRODUCTION

On April 19, 1999, the North Atlantic Energy Service Corporation (NAESC) completed augmented inspections of the full penetration welds in the Seabrook Nuclear Power Station (Seabrook) reactor pressure vessel (RPV), as required by the provisions in Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(g)(6)(ii)(A)(2). During the inspections, NAESC determined that it could not achieve the "essentially 100%" weld volume required by the rule for the inspections that were completed on the vessel's lower-head-to-lower-shell circumferential weld (RPV weld 104-141). On March 21, 2000, NAESC submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for approval of an alternate program (Alternate Request IR-9, Revision 0) for complying with this requirement. Additionally, for welds 104-141 and 102-151, NAESC submitted a request for relief (Relief Request IR-10, Revision 0) from the requirements of Table IWB-2500-1, Category B-A, Items B1.11 and B1.21, of Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (henceforth simply termed Section XI). These requests were submitted for U.S. Nuclear Regulatory Commission (NRC) review and approval. NAESC completed its volumetric inspection of the reactor vessel for the first 10-year inservice inspection (ISI) interval on April 19, 1999, during refueling outage 06 (OR06).

2.0 BACKGROUND

Seabrook is a typical 4-loop Westinghouse pressurized water reactor design. Located within the RPV are certain obstructions which may limit the amount of ultrasonic examination coverage that can be achieved for certain welds. NAESC was previously granted relief (IR-1) from the "essentially 100%" volumetric examination coverage requirements of Section XI for the reactor vessel lower-head-to-lower-shell circumferential weld 104-141 as outlined in Appendix BB of NUREG-0896, Supplement 9, "Safety Evaluation Report Related to the Operation of Seabrook Station, Units 1 and 2." However, the portion of this relief request associated with Item Number B1.11 was revoked as a result of the rulemaking (57 FR 34666) associated with the augmented examination requirements for the inspection of reactor vessel shell welds. Since the examination coverage obtained during the OR06 inspection of weld

Enclosure

104-141 was less than the "essentially 100%" criterion specified for the augmented and Section XI inspection requirements, this weld has been included in both requests (Request Nos. IR-9, Revision 0, and IR-10, Revision 0).

ASME Code Relief Request IR-1 also permitted reduced examination coverage (68 percent) of the reactor vessel lower head circumferential weld 102-151 (Item Number B1.21). However, since the coverage obtained for the subject weld during the OR06 inspection of the reactor vessel was less than the 68 percent that was previously approved, this weld has been included in the ASME Code Relief Request IR-10, Revision 0. Since weld 102-151 is not considered a reactor vessel shell weld, it has not been included in the alternative request (Request No. IR-9, Revision 0).

### 3.0 EVALUATION

#### 3.1 Applicable Regulatory Requirements

##### 3.1.1 For Alternate Request IR-9, Revision 0

Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.55a(g)(6)(ii)(A)(2) requires that a utility holding a license to operate a nuclear power generation facility augment its RPV examination by implementing once, as part of the ISI in effect on September 8, 1992, the examination requirements for RPV shell welds specified in Item B1.10 of Examination Category B-A, "Pressure Retaining Welds in Reactor Vessel," in Table IWB-2500-1 of Subsection IWB of Section XI of the ASME Code. It is specified in 10 CFR 50.55a(g)(6)(ii)(A)(2) that these augmented inspections of RPV shell welds shall cover "essentially 100%" of each weld. Essentially 100 percent is defined in the rule, and used in Table IWB-2500-1 of Section XI, as constituting more than 90 percent of the examination volume of each weld where the reduction in volume is due to interference by another component, or part geometry.

##### 3.1.2 For Relief Request IR-10, Revision 0

Title 10 of the *Code of Federal Regulations* Section 50.55a(g)(4) requires that throughout the service life of a boiling- or pressurized-water-cooled nuclear power generation facility, components (including supports) which are classified as ASME Code Class 1, Class 2, and Class 3, must meet the requirements, except design and access provisions and preservice examination requirements, set forth in Section XI.

The applicable edition of Section XI for Seabrook is the 1983 Edition of Section XI inclusive through the summer 1983 Addenda.

Section XI, Table IWB-2500-1, Inspection Category B-A, Item B1.11, requires that all circumferential welds in the reactor vessel shell must be volumetrically inspected during the first inspection interval of the plant-specific ISI program for the facility. Note 2 in the table identifies that the volumetric inspection must include "essentially 100%" of the length of the welds.

Section XI, Table IWB-2500-1, Inspection Category B-A, Item B1.21, requires that all circumferential welds in the reactor vessel heads must be volumetrically inspected during the first inspection interval of the plant-specific ISI program for the facility. Note 2 in the table

identifies that the volumetric inspection must include “essentially 100%” of the length of the welds.

### 3.2 Regulatory Alternative Provisions

#### 3.2.1 For Alternative Request IR-9, Revision 0

Title 10 of the *Code of Federal Regulations* Section 50.55a(g)(6)(ii)(A)(5) states that licensees that make a determination that they are unable to completely satisfy the augmented inspection requirements for RPV shell welds specified in 10 CFR 50.55a(g)(6)(ii)(A) shall submit information to the Commission to support the determination, and shall propose an alternative to the examination requirements that would provide an acceptable level of quality and safety.

Pursuant to 10 CFR 50.55a(a)(3)(ii), a nuclear licensee is permitted to use an alternative to the requirements of applicable portions of 10 CFR 50.55a if compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety, and if the alternative is authorized by the Director of the Office of Nuclear Reactor Regulation.

#### 3.2.2 For Relief Request IR-10, Revision 0

Pursuant to 10 CFR 50.55a(g)(5)(iii), a licensee is required to notify the Commission when it determines that conformance with certain code requirements is impractical for its facility. These notifications must include information to support such determinations.

Pursuant to 10 CFR 50.55a(a)(3)(ii), a nuclear licensee is permitted to use an alternative to the requirements of applicable portions of 10 CFR 50.55a if the licensee can demonstrate that compliance with the code requirement would result in hardship or unusual difficulty without a compensatory increase in the level of quality and safety, and if the alternative is authorized by the Director of the Office of Nuclear Reactor Regulation.

### 3.3 Licensee's Basis

During the volumetric inspection of the reactor vessel for the first 10-year inspection interval (conducted during the period of April 14, 1999, through April 19, 1999), NAESC determined that neither the UT examination of lower-head-to-lower-shell circumferential weld 104-141 nor the UT examination of lower head circumferential weld 102-151 resulted in a scanned weld volume that conforms to the "essentially 100%" inspection coverage stated in 10 CFR 50.55a(g)(6)(ii)(A)(2), or noted in the code requirements of inspection Items B1.11 and B1.21 to Category B-A of Section XI to the ASME Code. Weld 104-141 (the lower-head-to-lower-shell circumferential weld) is situated just below the six core support lugs, which are fixed in place. Each core support lug occupies about 20 degrees of space, including the attachment weld. This circumferential weld was completely scanned between the core lugs and the accessible areas below the lugs in both the parallel and perpendicular directions to achieve the maximum coverage. The total scan simple average for the weld length was 80 percent and the total scan simple average for the volume was 73 percent. The completion percentage was determined by calculating the percentage of actual coverage versus the total achievable coverage for each examination angle and for each examination direction. This was separated into weld volume and total volume. A weight factor of 0.25 was then applied to the

actual percent of coverage for each angle. Weld 102-151 (the lower head circumferential weld) is located in elevation at the periphery of the lower head penetrations. Weld 102-151 was volumetrically scanned in the segments that were accessible between the penetrations. The total scan simple average of the weld length for weld 102-151 was 61 percent and the total scan simple average for the volume was 61 percent.

NAESC assessed whether inspection of welds 104-141 and 102-151 was viable from the outer surface of the RPV. In order to examine the welds, NAESC determined that it would be necessary to erect scaffolding, remove thermal insulation, and prepare the RPV surfaces prior to conducting the ultrasonic examinations. Reinstallation of the insulation and the dismantlement of the scaffolding would also be required after the examinations. As can be seen from the following calculations, the estimated dose per weld incurred by parties involved in these inspection activities is estimated to be between 32 to 38 REM:

Install staging:	4 people X 8 hours = 32 p-hrs
Insulation removal:	2 people X 8 hours = 16 p-hrs
Surface preparation:	2 people X 8 hours = 16 p-hrs
Volumetric examination:	2 people X 16 hours = 32 p-hrs
Reinstall insulation:	2 people X 8 hours = 16 p-hrs
Remove staging:	2 people X 8 hours = 16 p-hrs
	128 p-hrs@250-300mR/hr = 32 -38p-REM

Since these dose rates are relatively high, NAESC concluded that the benefit to be gained by performing the examinations did not warrant the cumulative dose that would be incurred to inspection and maintenance personnel. NAESC therefore concluded that any volumetric examination of the welds from the outside surface of the RPV was not a reasonable option due to the extremely high dose that would be incurred by the personnel involved in the inspection activities.

### 3.4 Proposed Alternative Program

NAESC is not proposing to perform any additional augmented volumetric examinations of weld 104-141 required by 10 CFR 50.55a(g)(6)(ii)(A)(2), or the volumetric examinations of welds 104-141 and 102-151 as would be required by Inspection Items B1.11 and B1.21 to Inspection Category B-A of Table IWB-2500-1 of Section XI to the ASME Code for the first inspection interval. NAESC considers the percentage of welds inspected that was achieved during the previous volumetric examinations of the welds in April 1999 to be the maximum extent achievable with the obstructions in place. NAESC also considers the results of the previous volumetric examinations to be representative of the entire welds. NAESC has completed the visual VT-3 examinations of weld 104-141 as required by Inspection Item B13.10 of Inspection Category B-N-1 of Table IWB-2500-1 to the 1983 edition of Section XI. The RPV boundary, which includes the associated welds, was pressure-tested each refueling outage as specified in Table IWB-2500-1, Inspection Category B-P, Item B15.10. NAESC is proposing that the volume of coverage obtained for welds 104-141 and 102-151 during the reactor vessel inspections, when taken in context with the information obtained from the visual examinations and pressure tests, provides reasonable assurance of the continued structural integrity of the vessel and provides an acceptable level of quality and safety in lieu of complying with the weld volume requirements stated in 10 CFR 50.55a(g)(6)(ii)(A)(2), and in Inspection Items B1.11 and B1.21 to Inspection Category B-A of Table IWB-2500-1 of Section XI.

### 3.5 Staff Evaluation - Justification for Authorizing Relief

At Seabrook, neither the augmented examination requirements for lower-head-to-lower-shell circumferential weld 104-141 (material heat No. E56906), nor the first 10-year ISI requirements for lower-head-to-lower-shell circumferential weld 104-141 and lower head circumferential weld 102-151 (material heat No. 4P7656) could be met due to physical restrictions that limit ultrasonic scan coverage. In this case, six core support lugs on the inside surface of the vessel restricted the simple scan averages for lower-head-to-lower-shell circumferential weld 104-141 to 80 percent of the weld length and 73 percent of the weld volume, and the bottom head penetrations restricted the simple scan averages for lower shell circumferential weld 102-151 to 61 percent of the weld length and 61 percent of the weld volume. As a result of the augmented inspection requirements of 10 CFR 50.55a(g)(6)(ii)(A)(2) and the ISI requirements of Section XI, Table IWB-2500-1, Inspection Category B-A, Items B1.11 and B1.21, licensees must make a reasonable effort to maximize the volumetric coverage achieved during the examinations on their RPV welds. In cases where the volumetric examination coverage is inadequate, examination from the outside surface or outer diameter (OD) using manual inspection techniques may be an option. However, any efforts to perform manual volumetric examinations of the RPV weld from the outside surface would require NAESC to erect extensive scaffolding, remove insulation from the vessel, and perform extensive surface preparations for the examinations. These activities would result in significant radiological exposures to plant personnel performing these activities.

From the standpoint of protecting the Seabrook RPV against pressurized thermal shock (PTS), the Seabrook RPV is a plate-limited vessel. Thus, the material in the RPV that is most susceptible to radiation-induced embrittlement (i.e., the limiting material in the vessel) is lower shell plate R1808-1 ( $RT_{pts}$  value of 119 °F). With an  $RT_{pts}$  value of -18.1 °F, the RPV beltline welds (which were all fabricated from weld heat No. 4P6052) are significantly less susceptible to radiation-induced embrittlement than is the limiting material in the RPV (i.e., plate R1808-1). Neither weld 104-141 nor weld 102-151 are RPV beltline materials. Thus, the welds are not as susceptible to radiation-induced embrittlement as even the beltline welds are.

NAESC has already completed its augmented inspection of lower-head-to-lower-shell circumferential weld 104-141 and the first 10-year ISI examination of lower shell circumferential weld 102-151, and has scanned a significant portion of each weld's volume (73 percent and 61 percent, respectively). In addition, NAESC has also performed a VT-3 examination of weld 104-141 in accordance with Item B13.10 of Section XI, Inspection Category B-N-1, Table IWB-2500-1, and the required VT-2 examinations and pressure tests of the reactor coolant pressure boundary (Item B15.10 of Section XI, Inspection Category B-P) during each refueling outage for the plant. Since the Seabrook RPV is a plate-limited vessel, and since NAESC has inspected a significant portion of each weld's volume, and has performed the required visual examinations and pressure tests of the welds, the staff concludes that the proposed alternative to the examination requirements provides for an acceptable level of quality and safety. Performing additional UT examinations of the welds from the OD would not result in a significant enough increase in the level of quality and safety to warrant exposing the plant personnel to the additional radiological doses that would be incurred. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the staff concludes that compliance with the requirements to achieve an additional 27-percent weld volume coverage for weld 104-141, and an additional 39-percent weld volume coverage for weld 102-151, would result in a hardship for the utility without a compensating increase in the level of quality and safety for the plant. Therefore, the staff

concludes that NAESC's proposed alternative in Alternative Request IR-9, Revision 0, is authorized pursuant to 10 CFR 50.55a(g)(6)(ii)(A)(5) and 10 CFR 50.55a(a)(3)(ii), and that the proposed alternative in Relief Request IR-10, Revision 0, is authorized pursuant to 10 CFR 50.55a(a)(3)(ii).

Principal Contributor: J. Medoff

Date: September 20, 2000

Seabrook Station, Unit No. 1  
cc:

Lillian M. Cuoco, Esq.  
Senior Nuclear Counsel  
Northeast Utilities Service Company  
P.O. Box 270  
Hartford, CT 06141-0270

Mr. Peter Brann  
Assistant Attorney General  
State House, Station #6  
Augusta, ME 04333

Resident Inspector  
U.S. Nuclear Regulatory Commission  
Seabrook Nuclear Power Station  
P.O. Box 1149  
Seabrook, NH 03874

Town of Exeter  
10 Front Street  
Exeter, NH 03823

Regional Administrator, Region I  
U.S. Nuclear Regulatory Commission  
475 Allendale Road  
King of Prussia, PA 19406

Office of the Attorney General  
One Ashburton Place  
20th Floor  
Boston, MA 02108

Board of Selectmen  
Town of Amesbury  
Town Hall  
Amesbury, MA 01913

Mr. Dan McElhinney  
Federal Emergency Management Agency  
Region I  
J.W. McCormack P.O. &  
Courthouse Building, Room 401  
Boston, MA 02109

Mr. Stephen McGrail, Director  
ATTN: James Muckerheide  
Massachusetts Emergency Management  
Agency  
400 Worcester Road  
Framingham, MA 01702-5399

Philip T. McLaughlin, Attorney General  
Steven M. Houran, Deputy Attorney  
General  
33 Capitol Street  
Concord, NH 03301

Mr. Woodbury Fogg, Director  
New Hampshire Office of Emergency  
Management  
State Office Park South  
107 Pleasant Street  
Concord, NH 03301

Mr. Roy E. Hickok  
Nuclear Training Manager  
Seabrook Station  
North Atlantic Energy Service Corp.  
P.O. Box 300  
Seabrook, NH 03874

Mr. James M. Peschel  
Manager - Regulatory Programs  
Seabrook Station  
North Atlantic Energy Service Corp.  
P.O. Box 300  
Seabrook, NH 03874

Mr. W. A. DiProfio  
Station Director  
Seabrook Station  
North Atlantic Energy Service Corporation  
P.O. Box 300  
Seabrook, NH 03874

Mr. Frank W. Getman, Jr.  
President and Chief Executive Officer  
BayCorp Holdings, LTD  
20 International Drive, Suite 301  
Portsmouth, NH 03801-6809