

April 23, 2004

Mr. Roy A. Anderson  
President & Chief Nuclear Officer  
PSEG Nuclear, LLC - X04  
Post Office Box 236  
Hancocks Bridge, NJ 08038

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNIT NO. 1 - EVALUATION OF RELAXATION REQUEST NO. S1-RR-13-B22, RE: FIRST REVISED ORDER (EA-03-009) ESTABLISHING INTERIM INSPECTION REQUIREMENTS FOR REACTOR PRESSURE VESSEL HEADS AT PRESSURIZED WATER REACTORS (TAC NO. MC2266)

Dear Mr. Anderson:

On February 20, 2004, the U.S. Nuclear Regulatory Commission (NRC) issued First Revised Order EA-03-009. The original Order (EA-03-009), dated February 11, 2003, was superseded by the First Revised Order, and the revised Order continues to impose requirements for pressurized water reactor licensees to inspect reactor pressure vessel heads and associated penetration nozzles as stated in Sections IV.C.(5), (a) and (b). Sections IV.C.(5)(b)(i), (ii) and (iii) mandate requirements for nondestructive examination (NDE) of each penetration. Section IV.F of the revised Order states that requests for relaxation associated with specific penetration nozzles will be evaluated by the NRC staff using its procedure for evaluating proposed alternatives to the American Society of Mechanical Engineers Code in accordance with Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3).

By letter dated March 5, 2004, PSEG Nuclear LLC (PSEG) submitted Relaxation Request S1-RR-13-B22 requesting relaxation from the NDE requirements of the revised Order for the Salem Nuclear Generating Station, Unit No. 1, reactor vessel head vent nozzle penetration. PSEG's basis for this request is predicated on the fact that the vent nozzle is fabricated from SA-508-64 low-alloy steel with low-alloy steel weld metal which is not susceptible to primary water stress corrosion cracking (PWSCC).

The NRC staff has completed its review, and concludes that you have demonstrated good cause for the requested relaxation, in that the proposed alternative provides an acceptable level of quality and safety because the First Revised Order EA-03-009 was not intended to apply to materials not susceptible to PWSCC. Therefore, pursuant to Section IV.F of the First Revised Order (EV-03-009), the NRC staff authorizes the proposed relaxation and alternative inspection of the head vent nozzle penetration during the period that the Order is in effect.

R. Anderson

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The NRC staff's Safety Evaluation is enclosed.

Sincerely,

*/RA/*

Allen G. Howe, Acting Director  
Project Directorate I  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

Docket No. 50-272

Enclosure: As stated

cc w/encl: See next page

R. Anderson

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Allen G. Howe, Acting Director  
Project Directorate I  
Division of Licensing Project Management  
Office of Nuclear Reactor Regulation

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Enclosure: As stated

cc w/encl: See next page

DISTRIBUTION:

PUBLIC JClifford TChan PPatnaik CBixler, RGN-1 GHill (2)  
ACRS DCollins CRaynor OGC PDI-2 R/F

ADAMS Accession Number: ML040920361 \* SE input provide by memo. \*\* previous concurrence

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| DATE   | 04/06/04 | 04/06/04 | 03/25/04 | 04/07/04   | 04/13/04   | 4/22/04 |

**OFFICIAL RECORD COPY**

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELAXATION REQUEST NO. S1-RR-13-B22

FIRST REVISED ORDER (EA-03-009) ESTABLISHING INTERIM INSPECTION

REQUIREMENTS FOR REACTOR PRESSURE VESSEL HEADS

AT PRESSURIZED WATER REACTORS

SALEM NUCLEAR GENERATING STATION, UNIT NO. 1

PSEG NUCLEAR, LLC

DOCKET NO. 50-272

1.0 INTRODUCTION

On February 20, 2004, the U.S. Nuclear Regulatory Commission (NRC) issued First Revised Order EA-03-009. The original Order (EA-03-009), dated February 11, 2003, was superseded by the First Revised Order, and the revised Order continues to impose requirements for pressurized water reactor licensees to inspect reactor pressure vessel (RPV) heads and associated penetration nozzles as stated in Sections IV.C.(5), (a) and (b). Sections IV.C.(5)(b)(i), (ii) and (iii) mandate requirements for nondestructive examination (NDE) of each penetration. Section IV.F of the revised Order states that requests for relaxation associated with specific penetration nozzles will be evaluated by the NRC staff using its procedure for evaluating proposed alternatives to the American Society of Mechanical Engineers (ASME) Code in accordance with Title 10 of the *Code of Federal Regulations*, Section 50.55a(a)(3).

By letter dated March 5, 2004, PSEG Nuclear LLC (PSEG or the licensee) submitted Relaxation Request S1-RR-13-B22 requesting relaxation from the NDE requirements of the revised Order for the Salem Nuclear Generating Station (Salem), Unit No. 1, reactor vessel head vent nozzle penetration. PSEG's basis for this request is predicated on the fact that the vent nozzle is fabricated from SA-508-64 low-alloy steel with low-alloy steel weld metal which is not susceptible to primary water stress corrosion cracking (PWSCC).

This relaxation would only apply during the period in which the First Revised NRC Order EA-03-009 is in effect.

## 2.0 REGULATORY EVALUATION

First Revised Order EA-03-009 requires ultrasonic, eddy current, and/or dye penetrant testing of RPV head penetration nozzles at various intervals depending on their susceptibility to PWSCC. The Salem, Unit No. 1, RPV head is currently in the high susceptibility category. The requirements governing ultrasonic, eddy current, and/or dye penetrant testing for RPV heads in the high susceptibility category are stated in Sections IV.C.(5)(b)(i), (II), and (iii) of the Order.

Section IV.C.(5)(b) requires for each penetration to perform a nonvisual NDE in accordance with either (i), (ii) or (iii):

- (i) Ultrasonic testing of the RPV head penetration nozzle volume (i.e., nozzle base material) from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or the bottom of the nozzle if less than 2 inches; OR from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0-inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20,000 pounds per square inch (or 20 ksi) tension and greater. In addition, an assessment shall be made to determine if leakage has occurred into the annulus between the RPV head penetration nozzle and the RPV head low-alloy steel.
- (ii) Eddy current testing or dye penetrant testing of the entire wetted surface of the J-groove weld and the wetted surface of the RPV head penetration nozzle base material from at least 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 2 inches below the lowest point at the toe of the J-groove weld on a horizontal plane perpendicular to the nozzle axis (or the bottom of the nozzle if less than 2 inches; OR from 2 inches above the highest point of the root of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) to 1.0 inch below the lowest point at the toe of the J-groove weld (on a horizontal plane perpendicular to the nozzle axis) and including all RPV head penetration nozzle surfaces below the J-groove weld that have an operating stress level (including all residual and normal operation stresses) of 20 ksi tension and greater.
- (iii) A combination of (i) and (ii) to cover equivalent volumes, surfaces and leak paths of the RPV head penetration nozzle base material and J-groove weld as described in (i) and (ii). Substitution of a portion of a volumetric examination on a nozzle with a surface examination may be performed with the following requirements:
  1. On nozzle material below the J-groove weld, both the outside diameter and inside diameter surfaces of the nozzle must be examined.
  2. On nozzle material above the J-groove weld, surface examination of the inside diameter surface of the nozzle is permitted provided a surface examination of the J-groove weld is also performed.

### 3.0 TECHNICAL EVALUATION

#### 3.1 Components Covered by the Proposed Relaxation

Relaxation Request S1-RR-I3-B22 is applicable to the RPV head vent penetration nozzle for Salem, Unit No. 1.

#### 3.2 Licensee's Proposed Alternative Method

PSEG proposes to perform only a bare metal visual examination around the head vent nozzle penetration in accordance with paragraph IV.C.(5)(a) of First Revised Order EA-03-009.

#### 3.3 Licensee's Basis for Relaxation

As stated in Section 2.0, First Revised Order EA-03-009 requires that ultrasonic, eddy current, and/or dye penetrant testing be performed on all RPV nozzles. This would include the head vent nozzle for Salem, Unit No. 1. PSEG is requesting to exclude the head vent nozzle from inspection since it is not subject to the phenomena of PWSCC as identified in the Order.

For a penetration and its associated attachment weld to be susceptible to PWSCC, the following three conditions must be present.

- The nozzle and associated weld material must be fabricated from susceptible material.
- The penetration and the associated weld must be in contact with primary coolant water.
- A stress riser must be present.

It can be demonstrated that none of these conditions exist for the Salem, Unit No. 1 head vent nozzle and attachment weld.

CRDM penetrations and head vent penetrations are fabricated from Nickel-based alloys (e.g., Alloy 600) on most RPV heads. The weld material used to attach these penetrations to the head is also Alloy 600 on most RPV heads. Nickel-based alloys, and Alloy 600 in particular, are highly susceptible to PWSCC.

The Salem, Unit No. 1, head vent nozzle is fabricated from SA-508-64 low-alloy steel, and is not susceptible to PWSCC. Also, the weld filler material is low-alloy steel that is not susceptible to PWSCC. The inner diameter (ID) surface of the Salem, Unit No. 1 head vent nozzle and the ID surface to the attachment weld are clad with Type 316 stainless steel. Therefore, the only material in contact with the primary coolant is Type 316 stainless steel, which is not susceptible to PWSCC.

The CRDM housings at Salem, Unit No. 1, are attached to the head with a partial penetration J-groove weld. These weld joints have high residual stresses present because post-weld stress relief was not performed following welding. However, the Salem, Unit No. 1, head vent nozzle is a forged nozzle that is attached with a full penetration weld. The nozzle was installed prior to the post-weld heat treatment of the head, and was stress relieved. Therefore, the residual stresses in this nozzle are low. Based on the above, the Salem, Unit No. 1 head vent nozzle is

not susceptible to PWSCC and is [not subject to the] inspection required by First Revised NRC Order EA-03-009.

### 3.4 Evaluation

The NRC staff's review of this request was based on Criterion (1) of paragraph F to Section IV of the Order, which states:

The proposed alternative(s) for inspection of specific nozzle will provide an acceptable level of quality and safety.

Within the context of PSEG's request for relaxation from the NDE requirement of Section IV.C.(5)(b) in accordance with either (i), (ii) or (iii) for the RPV head vent nozzle penetration, the licensee has stated that the nozzle material is SA-508-64 that is welded to SA-508 vessel head material using a low-alloy steel filler metal. The ID surface of the Salem, Unit No. 1 head vent nozzle and the ID surface to the pressure retaining weld are clad with type 316 stainless steel. Operating experience has shown that none of these materials are susceptible to PWSCC for which the Order would be applicable. Since PWSCC is not likely to occur in the base metal or in the weld metal made of low-alloy steel for the RPV head vent nozzle, or the nozzle cladding, the NRC staff finds the requested relief from the examination requirements of Section IV.C.(5)(b) of First Revised Order EA-03-009 to be acceptable for the RPV head vent nozzle penetration on the basis that an acceptable level of quality and safety will still be provided. However, the requirement to perform a bare metal visual examination of the head surface 360 degrees around this penetration is still required in accordance with Section IV.C.(5)(a) of the First Revised Order.

### 4.0 CONCLUSION

The NRC staff concludes that the licensee's proposed alternative examination, as described in its request for relaxation from the nonvisual NDE requirements of Section IV.C.(5)(b) of First Revised Order EA-03-009 for the RPV head vent nozzle penetration, provides reasonable assurance of the structural integrity of the RPV head. Thus, the NRC staff concludes that the licensee has demonstrated good cause for the requested relaxation in that the proposed alternative provides an acceptable level of quality and safety. Therefore, pursuant to Section IV. F.(1) of First Revised Order EA-03-009, the staff authorizes the proposed alternative inspection for the RPV head vent nozzle penetration for Salem, Unit No. 1, during the time First Revised Order EA-03-009 is in effect.

All other ASME Code, Section XI, requirements for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: P. Patnaik

Date: April 23, 2004