

**AUG 31 2001**

LRN-01-268



United States Nuclear Regulatory Commission  
Document Control Desk  
Washington, DC 20555

Gentlemen:

**RESPONSE TO NRC BULLETIN 2001-01, CIRCUMFERENTIAL CRACKING OF  
REACTOR VESSEL HEAD PENETRATION NOZZLES  
SALEM GENERATING STATION UNITS 1 AND 2  
FACILITY OPERATING LICENSES NOS. DPR-70 AND DPR-75  
DOCKET NOS. 50-272 AND 50-311**

On August 3, 2001, the Nuclear Regulatory Commission (NRC) issued Bulletin 2001-01 referencing recent discoveries of cracked and leaking Alloy 600 Vessel Head Penetration (VHP) nozzles, including control rod drive mechanism (CRDM) and thermocouple nozzles, at four pressurized water reactors (PWRs). This has raised concerns about the structural integrity of VHP nozzles throughout the PWR industry. Nozzle cracking at Oconee Nuclear Station Unit 1 (ONS1) in November 2000 and Arkansas Nuclear One Unit 1 (ANO1) in February 2001 was limited to axial cracking, an occurrence deemed to be of limited safety concern in the NRC staff's generic safety evaluation on the cracking of VHP nozzles, dated November 19, 1993. However, the discovery of circumferential cracking at Oconee Nuclear Station Unit 3 (ONS3) in February 2001 and Oconee Nuclear Station Unit 2 (ONS2) in April 2001 particularly the large circumferential cracking identified in two CRDM nozzles at ONS3 has raised concerns about the potential safety implications and prevalence of cracking in VHP nozzles in PWRs.

The Bulletin requested that addressees provide information related to the structural integrity of the reactor pressure vessel head penetration (VHP) nozzles for their respective facilities, including the extent of VHP nozzle leakage and cracking that has been found to date, the inspections and repairs that have been undertaken to satisfy applicable regulatory requirements, and the basis for concluding that their plans for future inspections will ensure compliance with applicable regulatory requirements.

The bulletin requires that, within 30 days, all addressees provide to the NRC a written response in accordance with the provisions of 10 CFR 50.54(f).

*As of*

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The required 30-day response for Salem Generating Station Units 1 and 2 is included as Attachment 1 to this letter. Commitments contained in this response include (1) a visual examination of all VHP nozzles during the next refueling outages and (2) provide results of those examinations following these outages.

Should you have any questions regarding this request, please contact Michael Mosier at (856) 339-5434.

Sincerely,



Elbert C. Simpson  
Senior Vice President & Chief  
Administrative Officer

Attachment 1

C: Mr. H. J. Miller, Administrator - Region I  
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I declare under penalty of perjury that the foregoing is true and correct.

Executed on     **AUG 31 2001**    

  
Elbert C. Simpson  
Senior Vice President & Chief  
Administrative Officer

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**REQUESTED INFORMATION:**

- (1) All addressees are requested to provide the following information:
- a. The plant-specific susceptibility ranking for your plant(s) (including all data used to determine each ranking) using the PWSCC susceptibility model described in Appendix B to the MRP-44, Part 2, report;
  - b. A description of the VHP nozzles in your plant(s), including the number, type, inside and outside diameter, materials of construction, and the minimum distance between VHP nozzles;
  - c. A description of the RPV head insulation type and configuration;
  - d. A description of the VHP nozzle and RPV head inspections (type, scope, qualification requirements, and acceptance criteria) that have been performed at your plant(s) in the past 4 years, and the findings. Include a description of any limitations (insulation or other impediments) to accessibility of the bare metal of the RPV head for visual examinations;
  - e. A description of the configuration of the missile shield, the CRDM housings and their support/restraint system, and all components, structures, and cabling from the top of the RPV head up to the missile shield. Include the elevations of these items relative to the bottom of the missile shield.

**PSEG RESPONSE:**

- a. The susceptibility ranking for both Salem Units 1 and 2 are characterized as "those plants which can be considered as having a moderate susceptibility to PWSCC based upon a susceptibility ranking of more than 5 EFPY but less than 30 EFPY's from the ONS3 condition" (reference 1). Salem Unit 1 was calculated to be 13.8 EFPY's from ONS3 and Salem Unit 2 was calculated to be 17.4 EFPY's from ONS3.
- b. A description of the VHP nozzles, including the number, type, inside and outside diameter, materials of construction, and the minimum distance between VHP nozzles is shown in Table 1 (reference 2).
- c. The insulation type and configuration for both Salem Units 1 and 2 are reflective and horizontal.
- d. The Salem 1 results of most recent RPV head inspection were identified to the NRC on July 31, 2001 (reference 1). The Salem 2 RPV head has not been inspected within the last four years.

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The recent Salem 1 examinations were performed on all 79 vessel head penetrations by a certified level II examiner qualified in VT, 1-3 examination methods. All required insulation was removed to allow a direct visual examination, mirror aided, looking for any signs of boric acid crystals. The examination revealed no signs of boric acid on Salem 1 RPV head.

The top-of-RPV head inspection provided a reasonable confidence that PWSCC degradation would be identified prior to posing an undue risk. This visual examination was not compromised by the presence of insulation, existing deposits on the RPV head, or other factors that could interfere with the detection of leakage.

- e. Figure 1 shows the configuration of the missile shield, the CRDM housings and their support/restraint system, and all components, structures, and cabling from the top of the RPV head up to the missile shield. This includes the elevations of these items relative to the bottom of the missile shield.

**REQUESTED INFORMATION:**

- (2) If your plant has previously experienced either leakage from or cracking in VHP nozzles, addressees are requested to provide the following information:
  - a. A description of the extent of VHP nozzle leakage and cracking detected at your plant, including the number, location, size, and nature of each crack detected;
  - b. A description of the additional or supplemental inspections (type, scope, qualification requirements, and acceptance criteria), repairs, and other corrective actions you have taken in response to identified cracking to satisfy applicable regulatory requirements;
  - c. Your plans for future inspections (type, scope, qualification requirements, and acceptance criteria) and the schedule;
  - d. Your basis for concluding that the inspections identified in 2.c will assure that regulatory requirements are met (see Applicable Regulatory Requirements section). Include the following specific information in this discussion:
    - (1) If your future inspection plans do not include performing inspections before December 31, 2001, provide your basis for concluding that the regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.

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- (2) If your future inspection plans do not include volumetric examination of all VHP nozzles, provide your basis for concluding that the regulatory requirements discussed in the Applicable Regulatory Requirements section will be satisfied.**

**PSEG RESPONSE:**

No response is required to this request since, both Salem Units 1 and 2 have not experienced leakage from and cracking in VHP nozzles. See response to NRC Requested Information item (4) below.

**REQUESTED INFORMATION:**

- (3) If the susceptibility ranking for your plant is within 5 EFPY of ONS3, addressees are requested to provide the following information:**
- a. Your plans for future inspections (type, scope, qualification requirements, and acceptance criteria) and the schedule;**
  - b. Your basis for concluding that the inspections identified in 3.a. will assure that regulatory requirements are met (see Applicable Regulatory Requirements section). Include the following specific information in this discussion:**
    - (1) If your future inspection plans do not include performing inspections before December 31, 2001, provide your basis for concluding that the regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.**
    - (2) If your future inspection plans include only visual inspections, discuss the corrective actions that will be taken, including alternative inspection methods (for example, volumetric examination), if leakage is detected.**

**PSEG RESPONSE:**

No response is required to this request since, the susceptibility ranking for Salem Units 1 and 2 is greater than 5 EFPY and less than 30 EFPY of ONS3. See response to NRC Requested Information item (4) below.

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**REQUESTED INFORMATION:**

- (4) If the susceptibility ranking for your plant is greater than 5 EFPY and less than 30 EFPY of ONS3, addressees are requested to provide the following information:
- a. Your plans for future inspections (type, scope, qualification requirements, and acceptance criteria) and the schedule;
  - b. Your basis for concluding that the inspections identified in 4.a will assure that regulatory requirements are met (see Applicable Regulatory Requirements section). Include the following specific information in this discussion:
    - (1) If your future inspection plans do not include a qualified visual examination at the next scheduled refueling outage, provide your basis for concluding that the regulatory requirements discussed in the Applicable Regulatory Requirements section will continue to be met until the inspections are performed.
    - (2) The corrective actions that will be taken, including alternative inspection methods (for example, volumetric examination), if leakage is detected.

**PSEG RESPONSE:**

- a. For Salem Units 1 and 2, which are considered to have a moderate susceptibility to PWSCC based upon a susceptibility ranking of more than 5 EFPY but less than 30 EFPY from the ONS3 condition, a visual examination will be performed during the spring 2002 and fall 2002 respective refueling outages. A certified examiner will perform this visual examination. All VHP nozzles will be examined with the capability of detecting and discriminating small amounts of boric acid deposits from VHP nozzle leaks, such as were identified at ONS2 and ONS3. The inspections are expected to provide a reasonable confidence that PWSCC degradation would be identified prior to posing an undue risk. These visual examinations of Salem Units 1 and 2 RPV heads are not expected to be compromised by the presence of insulation, existing deposits on the RPV head, or other factors that could interfere with the detection of leakage.

If boric acid deposits are detected based on the top-of-reactor head visual examination and the root source of the boric acid deposits are determined to be emanating at the VHP nozzle welds under the reactor head; PSEG Nuclear, using available technology, will characterize the degradation. The

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balance of the VHP nozzle welds under the head will be inspected. Based on extent of the condition, repairs will be initiated.

- b. The technical basis for concluding that regulatory bases are met for Salem Units 1 and 2 is provided in MRP-48 (reference 2).

If boric acid deposits are detected based on the top-of-reactor head visual examination and the root source of the boric acid deposits are determined to be emanating at the VHP nozzle welds under the reactor head; PSEG Nuclear, using available technology, will characterize the degradation. The balance of the VHP nozzle welds under the head will be inspected. Based on extent of the condition, repairs will be initiated.

**REQUESTED INFORMATION:**

- (5) Addressees are requested to provide the following information within 30 days after plant restart following the next refueling outage:
- a. A description of the extent of VHP nozzle leakage and cracking detected at your plant, including the number, location, size, and nature of each crack detected;
  - b. If cracking is identified, a description of the inspections (type, scope, qualification requirements, and acceptance criteria), repairs, and other corrective actions you have taken to satisfy applicable regulatory requirements. This information is requested only if there are any changes from prior information submitted in accordance with this bulletin.

**PSEG RESPONSE:**

This information will be provided following the next refueling outage(s) for both Salem Unit 1 and Salem Unit 2. The next Salem Unit 1 refueling outage is currently scheduled to start in October 2002 and the next Salem Unit 2 refueling outage is scheduled to start in April 2002.



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**References:**

1. NEI letter from Mr. Alexander Marion to Dr. Brian Sheron, subject: "NRC Staff Questions on EPRI Interim Report TP-1001491, Part 2, Section 4.0, Comment No. 2" in the table "Key Plant Parameters for PWR Reactor Vessel Head Nozzle PWSCC Assessments (July 2001)."
2. NEI letter from Mr. Alexander Marion to Dr. Brian Sheron, dated August 21, 2001, subject: "EPRI Report TP-1006284, "PWR Materials Reliability Program Response to NRC Bulletin 2001-01 (MRP-48)."
3. "PWR Materials Reliability Project Interim Alloy 600 Safety Assessments for US PWR Plants (MRP-44), Part 2: Reactor Vessel Top Head Penetrations, EPRI Report TP-1001491, Part 2," dated May 2001.

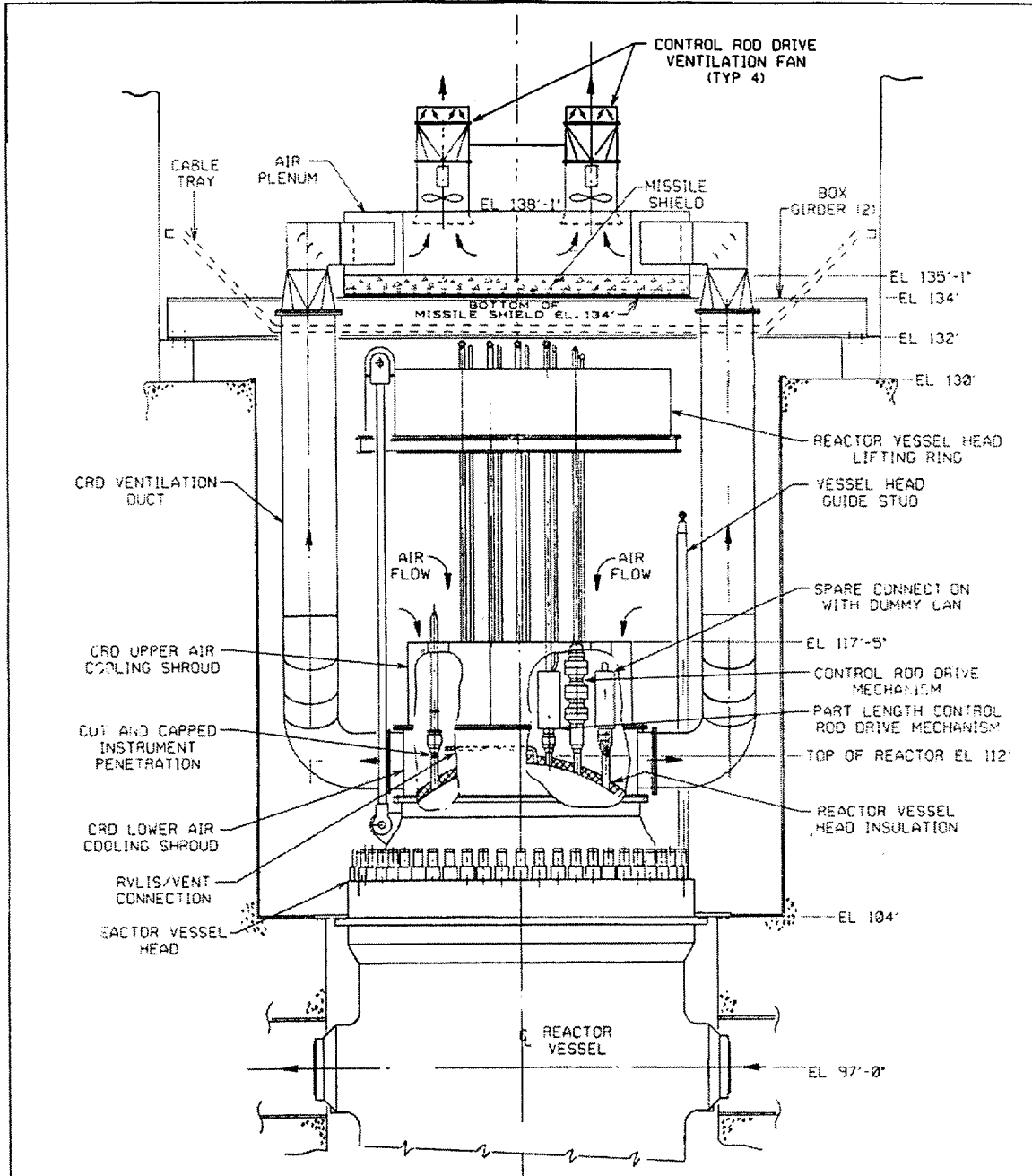
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Table 1

<b>Parameter Requested</b>	<b>Salem 1</b>	<b>Salem 2</b>
Number of CRDM VHP Nozzles	79	78
CRDM Nozzles (reference 3)	Fig. A-3b	Fig. A-3a
Inside Diameter, CRDM Nozzle	2 ¾ "	2 ¾ "
Outside Diameter, CRDM Nozzle	4"	4"
Minimum Distance between VHP nozzles	7.973" or 11.973" CL to CL	7.973" or 11.973" CL to CL
Number of Head Vent Nozzles	1	1
Head Vent Nozzle (reference 2)	J-Groove Weld	J-Groove Weld
Material of Construction	Inconel 600	Inconel 600

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**FIGURE 1**



REF. DRAWINGS: CRDM MISSILE SHIELD #219159-A-8924 &  
CABLE TRAY ASSEMBLY AT REACTOR HEAD #223025-A-8987

NOT TO SCALE	AUG. 2001
ATTENTION: ANY REVISION TO THIS DRAWING SHALL BE MADE ONLY BY CAED	
PSEG NUCLEAR LLC SALEM NUCLEAR GENERATING STATION CONFIGURATION SCHEMATIC OF SALEM VHP (VESSEL HEAD PENETRATIONS), MISSILE SHIELD & CABLE TRAY	

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